American Machinist

Established 1877 McGraw-Hill Publishing Company, Inc.

New York, February 19, 1931

BESIDES discussing the principles of feeds and speeds, with their dependence on materials, tools, and cutting lubricants, Mr. Broderick presents a nomographic chart which should prove practical and valuable in the determination of basic cutting factors for all standard materials. This chart may readily be altered for particular adaption to any individual plant and any given set of conditions

The Probable Speed of Machining

A. H. Rodrick

IN AN ERA of increasing mass production, when small unit gains may result in large over-all savings, the subject of speeds and feeds in machining operations is important; the time required for turning, planing, drilling, boring, or milling any material is largely determined by the cutting speed of the tool and the rate of feed. The two main factors which enter into the question of increased speeds are the quality of the cutting tool, and the kind of material being machined.

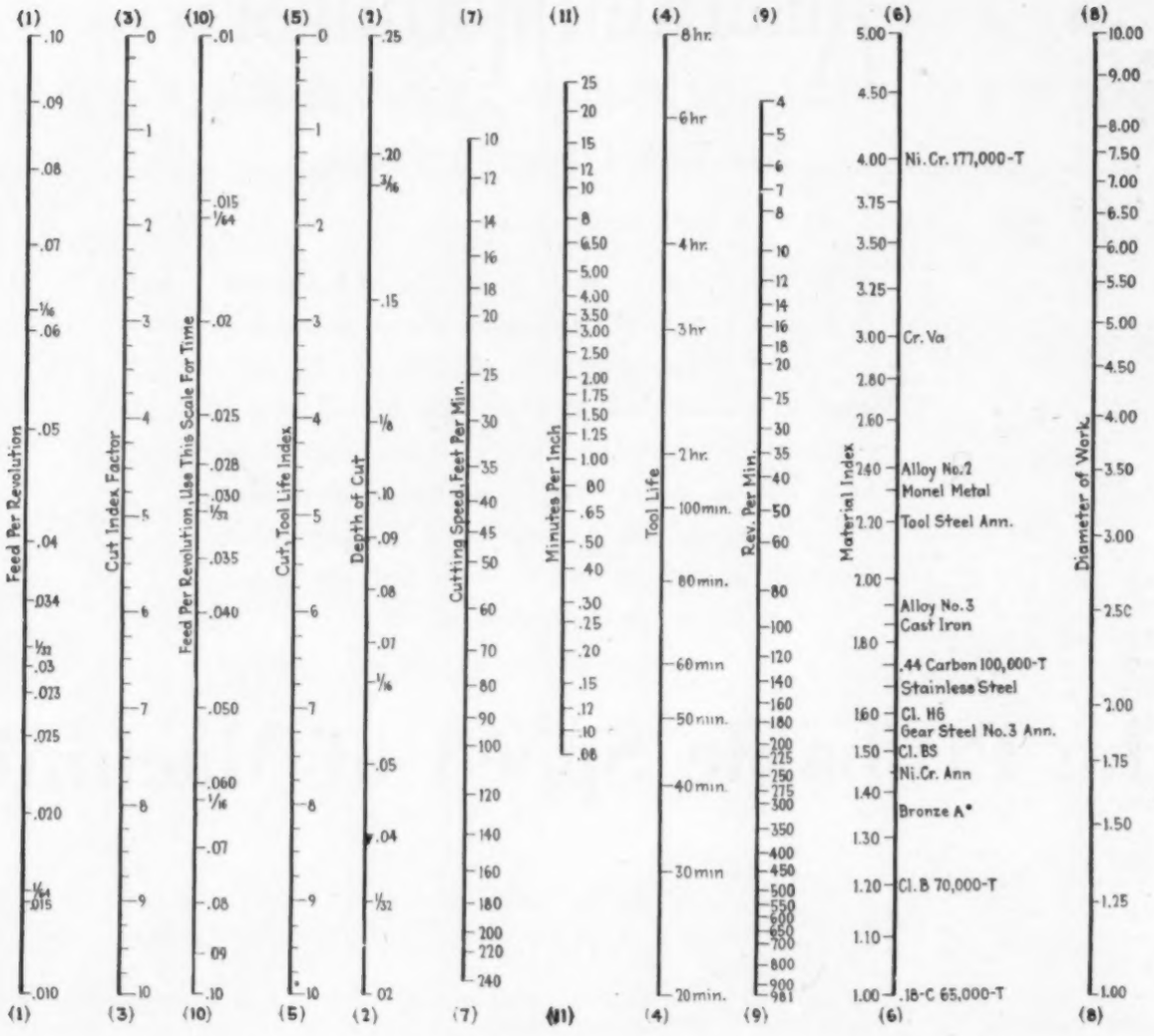
Three important elements must be considered in determining the kind of cutting tools to be used, namely, the composition of the material, the shape of the tool, and its heat treatment.

Cutting tools are made in high-carbon steels, alloy steels, and the higher alloys or high-speed steels. For this discussion they may be separated in two groups, namely, those which lose temper at from 400 to 500 deg., and those which retain their hardness at perhaps 1,000 deg. F. The former cannot be used at speeds which raise the cutting edge temperature over 300 deg.; the latter, by virtue of their high-heat hardness, can be used at relatively high speeds. Early conceptions were to the effect that high-speed steel was not superior to the carbon steels unless run at high speeds, but with improved alloys and heat treatments late practice has adopted high-speed steel for all cutting tools with few exceptions. The reason for this is that it resists the chip abrasive action better, keeps a keener cutting edge, and, when heat treated to equal hardness, is stronger and does not chip so readily. This is true whether the material being machined is hard or soft, ferrous or non-ferrous.

The work of a cutting tool is to force itself through the metal, and in doing this it must face three conditions, pressure, friction, and abrasion. Changes in its durability, therefore, are mainly caused by changes in the temperature of the cutting edge. The temperature of the tool may be varied without disturbing the cutting speed by changing the temperature of the coolant or the depth or feed of the cut. All tool steels lose their durability when the cutting speed is raised above a certain limit.

Durability of the turning tool; hardness of the metal being turned; and the use or non-use of a coolant are the factors which govern the time a tool can be used before grinding becomes necessary. If the cutting speed is too high, even though high-speed steel is used the point of the tool will become softened by the heat generated by pressure and friction. If the speed is too slow the tool point will become dulled by being worn or ground away. In the latter case a tool can be used longer, but it is uneconomical because of the time required for removing the amount of metal. The better practice is to fix a speed which will provide the greatest amount of work before the tool requires re-grinding. It does not pay to grind a tool frequently to retain a high speed, and a corollary of this is that it does not pay to use a slow speed to save the time of re-grinding the tool. Frederick W. Taylor, father of scientific management, found by experiments that it was not economical to use roughing

CHART FOR DETERMINING MACHINING FEEDS AND SPEEDS



tools at a speed so slow as to cause them to last more than 1½ hours without being re-ground. This, however, was on heavy work.

The greatest care must be exercised in grinding drills if the best results are to be obtained. For steel and cast iron they may be ground about the same, but for brass or other soft metals the lip of the drill should be altered in such a manner that the drill will not draw into the metal. This is accomplished by removing the extreme sharp edge. Drills should be machine ground rather than ground by hand. If ground by hand, one lip of the drill is likely to be longer than the other, thus causing one side of the drill to do all the cutting. This condition will also cause the drill to cut large. If drills are properly ground, the chip will be severed in a small compact roll from both sides.

Cutting is chiefly a shearing action, and the initial cut or start of the tool is the most difficult phase of the operation. It has been found that the temperature of the cutting edge of the tool is a good measure of the resistance to cutting offered by a material.

The metal being machined is, as previously referred to, an important factor in determining the proper speeds. For example, machine steel can be turned at a greater speed than either gray cast iron or annealed tool steel. Soft yellow brass can be turned at a much greater speed than hard bronze. The feed used for turning soft machine steel can be increased when turning soft cast iron. In lathe work, metal can be removed quicker by using a coarse feed and slow speed than by using a fine feed and higher speed. In milling, the speed of the cutter depends upon the kind of material being milled and the condition of the cutter. With high-speed steel cutters the speeds can be twice those with carbon cutters, and if steel or wrought iron is being milled, the application of a lubricant to the cutter makes still higher speeds possible. Steel of different contents will vary as to machinability. Tests show that steel containing 0.3 per cent carbon and 3½ per cent nickel has better machinability at any selected tensile strength up to about 160,000 or 170,000 lb. per sq.in. than steel of similar or higher carbon content containing 1 per cent chromium with or without vanadium or molybdenum. The same applies to a comparison between the 3½-per-cent nickel and the somewhat higher-carbon nickel-chromium steels. However, above 170,000 lb. per sq.in. tensile strength the order of superiority is reversed and the chromium-molybdenum and nickel-chromium steels permit higher cutting speeds.

The use of proper cutting lubricants and coolants makes a higher cutting speed possible. Friction, which is the resistance created by the surface of one body mov-

ing over the surface of another, will always be present in machining operations since it cannot be entirely eliminated. The heat generated at the point of the tool causes the cutting edge to wear rapidly. Efficient cooling, therefore, by means of proper lubrication will reduce the temperature caused by friction, increase the life of the tool from 10 to 15 per cent, and add materially to the smoothness of the cut, a most essential factor.

A proof of the importance of using the proper kind of lubricant is found in the fact that dies, taps, reamers, and form tools will have a longer life when used on tough steel if the coolant is a cutting oil rather than an emulsion.

Friction during the machining operation causes the metal being cut, as well as the tool, to heat up. When the metal cools it contracts and the dimensions will differ from the measurements taken during the process of machining. The metal must therefore be cooled the same as the tool, especially under high-speed conditions and with such metals as have a high coefficient of expansion.

Lubrication is Important

When the metal being machined is tough the question of lubrication is very important, since the cuttings are removed in the form of spiral shavings, which grind their way over the nose of the tool. Shavings on the side not in contact with the tool should also be cooled, particularly with tough material, since the difference in temperature between the two sides of the shaving causes contraction on the cold side and helps to reduce the friction produced by the shavings rubbing over the nose of the tool. The character of the chips or shavings produced will depend upon the form given to the tool by grinding and also upon the angle at which it is used.

The best kind of coolant for general operations where steel is being machined is a low velocity, low viscosity oil delivered close to the cutting edge of the tool. The viscosity of an oil is, of course, a measure of its resistance to flow; a high viscosity oil is therefore "thick"; a low viscosity, thin. If the coolant is delivered in a thin stream at high velocity it will not remove the heat effectively and will cause splashing. For high-speed work the cutting oil should have sufficient fluidity to ensure a rapid stream being concentrated where required.

Before selecting the correct grade of cutting lubricants, important factors should be considered; such as cutting speed and depth of cut, and material under manufacture. For example, a low speed and shallow cut require less cooling and lubrication. A low speed and heavy cut require a lubricant possessing great oiliness. A high speed and shallow cut require a cutting emulsion of great cooling properties. A high speed and heavy cut require a cutting lubricant of cooling as well as lubricating properties. A heavily compounded cutting lubricant of low viscosity should be used, the low viscosity for the cooling effect and the heavy compounding to lubricate the tools and shavings.

Cutting emulsions of which water is an ingredient will cause rusting if used too weak. A good cutting oil used "straight" will prevent this corrosion, but is expensive.

By using a coolant, the gain in cutting speed is about 15 per cent with current commercial types of steel, and if a low viscosity cutting oil possessing great oiliness is used "straight," a smoother cut and better finish will be obtained.

The removal of chips is also a function of the coolant, and if the cutting emulsion stream is too weak it will not carry away with it the minute particles of metal and scale, which may prove detrimental to the machine tool.

The most widely used coolants are: (1), Water, mixed with alkali, fatty oil, mineral oil, soap, or sulphur; (2), Fatty oil, mixed with mineral oil, sulphur, kerosene, or turpentine; (3), Mineral oil, mixed with kerosene; and (4), Kerosene. The use of kerosene as a coolant or as a mixture with any kind of oil to form a cooling liquid is a dangerous practice and has been the cause of fires.

The object of all lubrication is that the lubricant should attach itself to the rubbing surfaces, and form a film between them, which under the conditions of speed, pressure, and temperature prevailing, will not be squeezed out, but will keep the frictional surfaces apart.

It is impossible to lay down any invariable set of rules to follow in the case of increased speeds. Even the machinist who operates a lathe does not always know what cutting speeds are used, but follows past experience. The modern method of machine set-up and operation is to try out best combinations and fix the speeds and feeds to suit the tool, tool life, and material, as well as many other factors. Not only are there variations in the machinability of metals of nearly identical analysis, but also in the composition and heat treatment of high-speed steels, the tool life of which may vary three to one. The problem resolves itself into one of research and experiment for each particular case.

A Useful Chart

When the best combinations have been determined, however, a chart can be prepared, similar to the one shown, for which I am indebted to J. W. McConnell, Member A.S.M.E. This nomograph will prove very useful in determining the best probable speed.

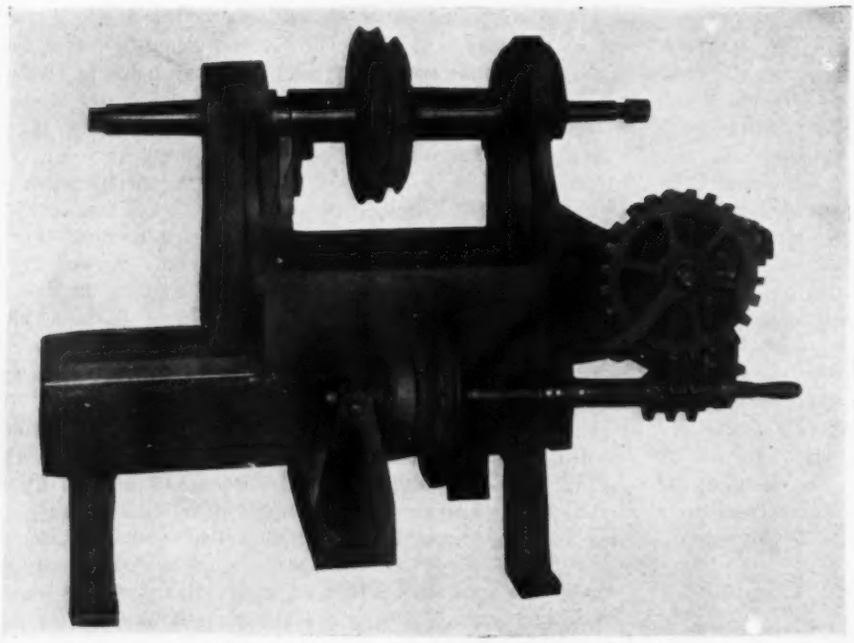
Instructions for using the chart are:

1. Select feed and depth of cut to suit stock to be removed, stiffness of work, and machine. Use large tool radius for heavy cuts.
2. Run a line from feed (1) to cut (2) and get intersection on (3).
3. Run a line from intersection (3) to tool life (4) and get intersection on (5).
4. Run a line from intersection (5) to material (6) and get cutting speed (7).
5. Run a line from cutting speed (7) to diameter (8) and get r.p.m. (9).
6. Run a line from r.p.m. (9) to feed (10) and get minutes per inch (11).

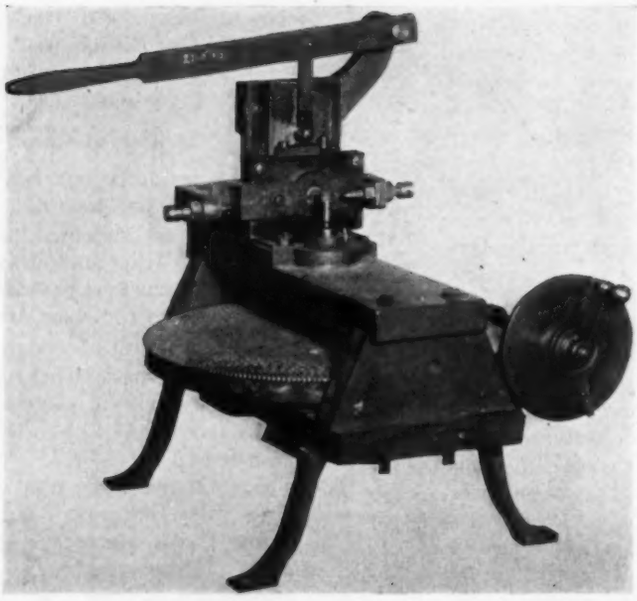
For example, take the following combination: A shaft, 3.0 in. diameter, 0.44 carbon steel, 100,000 tensile strength, $\frac{1}{8}$ in. depth of cut, 0.04 in. feed, and tool life 1 hour. Place a ruler on 0.04 (column 1) and $\frac{1}{8}$ (column 2) and the intersection in column 3 is $4\frac{3}{4}$. Place the ruler on $4\frac{3}{4}$ (column 3) and 60 (column 4) and the intersection in column 5 is $5\frac{1}{8}$. Place the ruler on $5\frac{1}{8}$ (column 5) and 0.44 carbon (column 6) and the intersection in column 7 is 55. Place the ruler on 55 (column 7) and 3.00 (column 8) and the intersection in column 9 is 70. Place the ruler on 70 (column 9) and 0.040 (column 10) and the intersection in column 11 is 0.37 minutes per inch of cut.

In use, such a chart must be considered basic only, and should satisfactory results not be obtained, a check up should be made of such probable causes as material, coolant, composition and condition of tools, shape of cutting edge, tool mounting, or chip interference.

MILLING



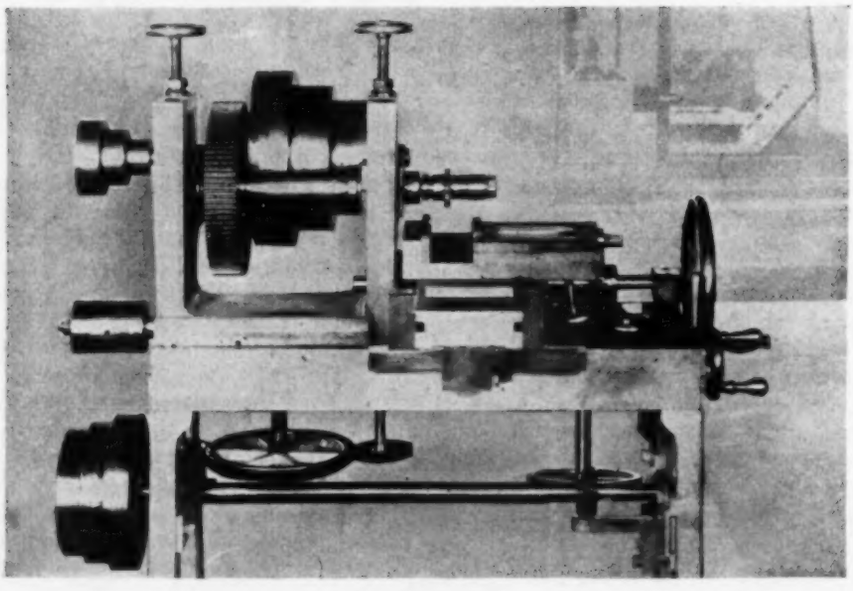
IN the French Encyclopedia of 1772, a light sort of milling machine was shown, but the machine proper was distinctly an American development. It was invented by Eli Whitney some time prior to 1818 for use in gun building, and has since proved itself one of the two most important types of machines for the system of interchangeable manufacture. These early examples are on exhibition at the Museum of Science and Industry in the City of New York.



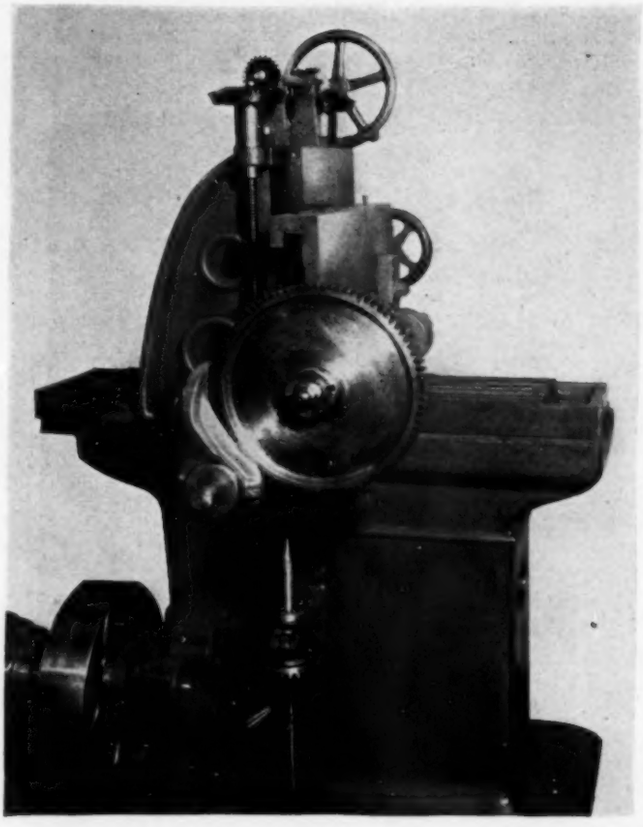
TOP
Eli Whitney's original milling machine, built prior to 1818

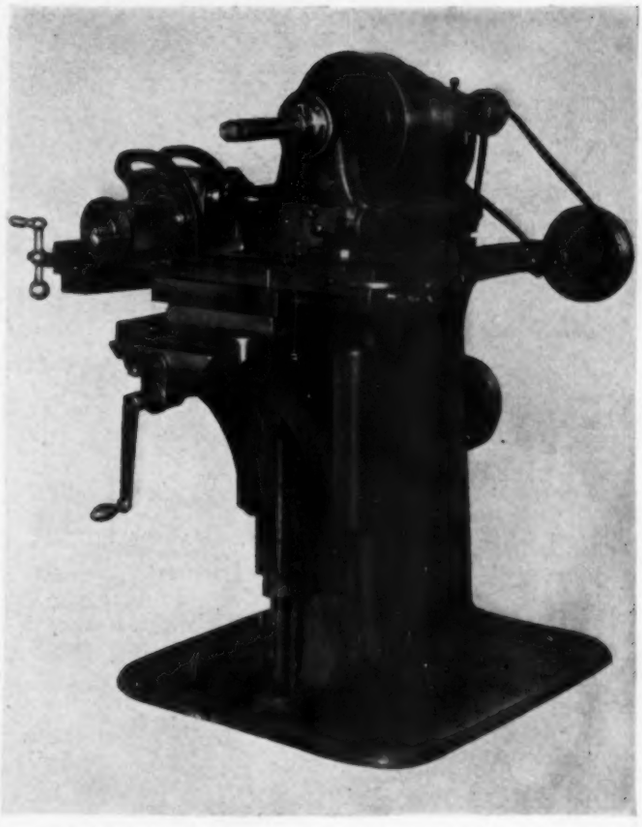
LEFT
A 100-year-old index milling machine, used for cutting clock gears

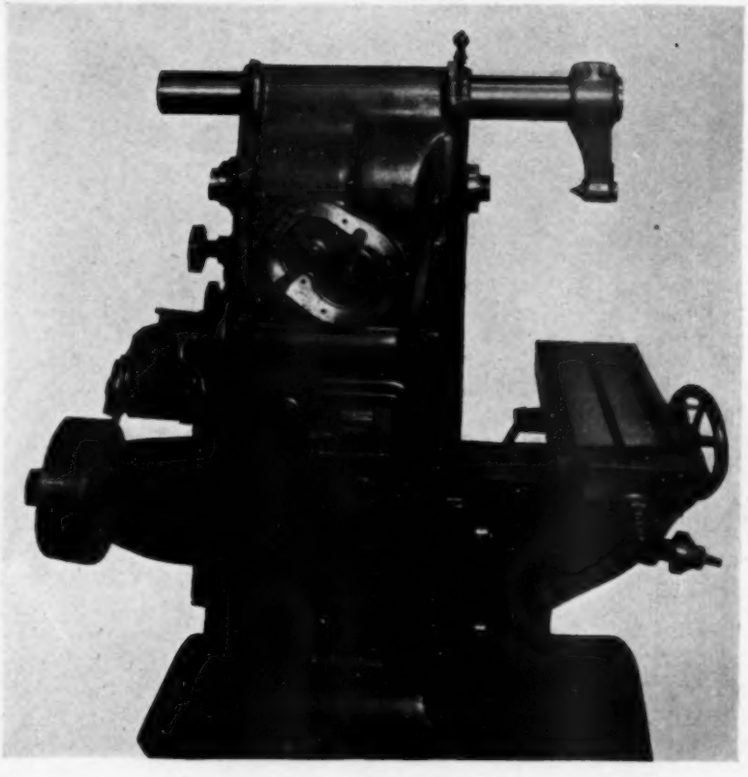
BELOW
Robbins & Lawrence milling machine of 1850, forerunner of the Lincoln milling machine



MACHINES of Yesteryear







TOP LEFT
An early planer-type miller, loaned by the Ingersoll Milling Machine Company

TOP RIGHT
The oldest Brown & Sharpe milling machine known to be in existence

LEFT
The original all-gear drive milling machine of the knee type, courtesy of Kearney & Trecker

EXECUTIVE FORUM

Come Seven?

J. J. MASFIELD, President of the Masfield Foundry & Machine Company, sat at his table in the Manufacturers Club. He puffed his cigar thoughtfully. Opposite him sat Bill Holland, similarly engaged. As a rule, these two attempted to thresh out matters of industrial importance; the present occasion was no exception.

"I'm considering a seven-hour day for my plant," said Masfield. "I've heard a lot of speeches and read a lot of articles on the machine age. Most of them take the optimistic view that everything's going to be all right—it's always worked out before, so it will again. I'm an optimist myself, but I don't believe in being fatalistic to the degree of doing nothing to remedy conditions."

"Let me get you straight," said Bill. "You're cutting working hours because you haven't sufficient work for full time. Other manufacturers have done the same. But why get philosophic about the machine age?"

"Others have come to a shorter day as an emergency measure," said Masfield. "I believe in going further and establishing the seven-hour day as standard to counteract the increased output of mechanical production. The present time is opportune to inaugurate such a move, but to get the full benefit, we should stick to it when business improves."

"What would you gain?" asked Bill. "We have an industrial set-up for great productivity. Artificial curtailment of machine- and man-power would result in great waste."

"Not at all," said Masfield. "Mechanical development has progressed beyond our ability to consume. The machine should be a servant and not our master. We need more leisure—more time to enjoy the fruits of our productive capacity. What justification is there for our complex civilization other than greater comfort and opportunity for the enjoyment of life?"

"Most people have as much time to themselves now as they can use intelligently," said Bill. "We haven't yet reached the stage where more leisure is necessary or desirable. The consumption of goods is far below the potential of even present-day living standards. If we are to improve these standards, we should produce more instead of less. Our problem lies in better means for distribution rather than curtailed output."

"My plan would promote wider distribution," said Masfield. "Suppose all industry went to a seven-hour day tomorrow. Unemployment would be practically eliminated. People would have more time to spend money. The net result would be an immediate improvement in business."

"It's not so easy as that," said Bill. "When you cut production you increase costs. Overhead goes up and prices follow. You didn't say whether your scheme includes increased hourly wages, but if it does, prices will go still higher. The process is like lifting yourself by your boot straps. The better solution lies in hard work, efficient machines, and increased consumption."

"We have efficient machines and men ready for hard work," said Masfield. "You're like the rest of the fellows who believe in marking time and letting events shape themselves. I don't claim my action in going to a seven-hour day alone will make much of a dent in the situation. But if enough manufacturers joined me the effect would be felt at once."

"You talk of making seven hours standard," said Bill. "But as soon as sales increase, you'll be back to eight or ten. Adjust your hours to suit your orders if you will, but don't fool yourself that you're solving the world's economic problems."

Topic suggested by A. E. Fristedt, Bolinder Works, Stockholm, Sweden

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What Do You Think About This Problem?

Most of the comforts of civilization are due to mechanical development. We enjoy the use of devices unknown a half century ago. Former luxuries are now within the reach of thousands of people. But is the mechanical force, we have created, likely to get beyond our control? Will it be necessary to use some means such as a shorter working day to counteract the increased output of the machine? Is the human race ready for a greater percentage of leisure time?

. . . Discussion

of Executive Problems

■

No Change

Labor turnover in most plants is largely caused by poor management. To reduce labor turnover a plant must have contented employees. The three things that make an employee want to stay with his job are first wages, then steady employment, and last good working conditions.

For the past seven years, I have been connected with a firm that has not had a man leave and only one discharged, while other plants in our vicinity have a large turnover. This condition is because of the fair wages paid, a light clean shop to work in, and a plant that has the reputation of steady employment.

—L. G. PATTERSON, *Factory Superintendent, Armstrong Machine Works.*

Anticipation Without Realization

It is not presumptuous for a man to expect to receive a bonus, which has regularly been paid, when no announcement has been made as to a change of policy. Established custom frequently has the effect of a promise. The man who anticipated the bonus may have contributed more in loyalty and faithfulness than he would if he did not have the prize for which to work. And he can hardly be blamed for thinking that he had earned it.

The bonus is supposed to be a reward for extra effort made by the employee. A bonus to an underpaid workman is taken as an insult, as he believes it is an attempt to quell his discontent with low wages and to persuade him that he is getting more than he earns. But a concern that pays its men their true value may be assured that the bonus will be taken in good faith and create good will. A few claim that they want the bonus in the form of a raise in wages, but most men prefer a bonus of ten dollars a year to a rise of twenty cents a week.

— HARRISON G. BROWN, *Supervisor of Standards, Crompton & Knowles Loom Works.*

Few managers would admit that a bonus for ten years service is deferred wages. Such a system would be grossly unfair to a large proportion of the workers who for one reason or another would not be eligible for the bonus. We can assume that the originators of such a bonus intended it as something over and above a fair day's wage.

From this standpoint men would be presumptuous in assuming that the money was due them. The bonus is a voluntary gesture on the part of the management, and it would be within the rights of a new management to discontinue the practice without notifying the employees. However, it would be more politic for the management to announce in advance the change in policy, and in this way pave the way for further changes in the régime without incurring antagonism. Secrecy arouses distrust on the part of the employees. The question uppermost in their minds will be "What rights and privileges will they take from us next?"

As the back-bone of every organization is the group of employees who remain at their job year after year, it is the duty of the management to take these employees into its confidence and announce in advance any changes in policy that will affect them.

The highest quality of workmanship is only obtainable from happy and care-free workers. And when the management expresses its appreciation for long continued service with a special award the recipient will certainly be inspired to greater effort.

—J. A. LAWSON, *The Heald Machine Company.*

Dole or Control?

During the past summer, I spent three months in England, and endeavored to get a true picture of the working of National Unemployed Insurance there. This is financed by the weekly contributions of the employee, employer, and the government. As a remedy, it has completely failed, but as a relief, it has without doubt kept thousands from starvation. It must not be thought that a dole of about four or five dollars per week is sufficient to live on there. The English are a thrifty people, and with their savings and the dole, they are just able to manage.

I have heard it said that the dole makes loafers, but I believe the vast majority would gladly work had they the opportunity. However, the National Unemployment Insurance does lower ambition and makes a man think that every advancement in life should come through the government.

However good the dole may have been as a relief in England, I do not think it would work out successfully here. In England, they are dealing almost wholly with their own people, but here we have millions of aliens.

—ALFRED LAYZELL.

After having conversed with a number of mechanics, who have recently come to this country from England, I believe anything is preferable to the government dole. They agree that men are actually encouraged to loaf, which is not a desirable condition. The employer is not to blame for the lack of business and is certainly suffering from it also. Nor should he be obliged to support his employees in hard times, as he would be only too glad to give them work if he had it. The best system of helping the workers at a time like this is one that is being used at a plant not far from here.

A system has been devised whereby, all employees that are not working full time, are paid a full week's pay at day work rates; the employees in turn sign a paper to repay in small weekly payments the difference between their actual earnings and what they are paid. These slips are filed away, and as soon as a man gets back to his full earning power, he has a small sum

deducted each week until the sum is fully paid up. This is working out splendidly, and although it is a tax on the employer, he is holding his men at no actual cost, as he is protected by the signed slips. Even though it does drain the treasury a little, he is losing no men, and has faith enough in conditions to continue this practice. Incidentally, a concern doing this type of thing, in my opinion, need never worry in good times about losing their men to higher paying companies, as men do not forget as easily as some people believe.

—CHARLES R. WHITEHOUSE, *Standards Engineer, The Holtzer-Cabot Electric Company.*

The More the Brainier?

The average shop of today recognizes that one man cannot know all about any one subject. This brings interlocking responsibility to determine why a certain method should be followed, but generally leaves one individual responsible for putting it through. We must be broad enough to see that the committee or conference is the lending of many helping hands to the individual responsible.

My experience has proven that we could successfully solve vexing problems when several heads worked on the particular job before us. I have also found that it tended to build up a mutual confidence in the committee members. In at least fifty per cent of the problems under discussion, we have found somebody contributing ideas, which, while not applicable for the particular problem, helped one of the other committee members on some of his problems.

It is false economics to make one man solely responsible for a job from the time of its conception till it is successfully concluded or rejected. There are too many valuable men who would be broken in spirit if they failed on working out problems alone. They would be afraid to advance ideas and initiative; the motive power of industry would be lost. Practical ideas breed more practical ideas, which are the basis of all industry.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

This sounds logical but is not practical. Years ago he was employed by a concern building a large line of machines. Every once in a while, I noticed the old man sitting on a bench all alone looking at a half finished machine. Now and then he would have the toolmaker or one of the foremen make a new part. Eventually a new design would materialize.

Now instead of just one man and an assistant thinking out the hard spots, we have a number of experts. Each one wants his ideas to be carried out and to get the credit for them, but none want to share the blame for mistakes.

—H. FORSCHNER.

Ex Rights

Practically any attempt to prevent the removal of forms used in a plant is a hopeless task, as there are so many simple ways of securing actual copies or duplicates of them. Any attempt to retain such information sacred within the walls of the plant is a gesture indicating reverence of a symbol rather than the thing itself. It has long been a practice with many members in a certain engineering society to distribute a complete set of forms used in a given plant to members making inspection trips during conventions. These simply served as concise memoranda of how certain functions were being taken care of at these plants. The systems revealed were not intended to be transplanted bodily. The likelihood of their being used detrimentally was not considered serious by the organizations following this practice. The interchange of ideas usually resulted in a marked benefit to all concerned rather than a gain by some at the expense of those broad-minded enough to reveal their methods.

There are certain principles governing plant operation and organization that must be recognized in establishing a system, and in drawing up forms. While these principles apply universally, the systems that result and the forms designed to suit conditions in a given plant seldom succeed if deliberately copied or transplanted to another organization. The most complete failure I ever saw was the installation of an elaborate production control system that was copied directly from a very successful installation of the same forms and devices.

—W. B. LINCOLN, *Chief Engineer, W. J. Savage Company.*

In removing his personal effects after resigning, a man has no right to take with him a sample set of forms without having first obtained the sanction of his superior. The latter will readily grant it, if he has had experience in organization and methods changes, based on the belief that a system of proved success in one company cannot be adopted by another merely because of that success. The money that has been wasted in mistaken system turnovers would be a sizable fortune for an individual.

Knowing this, very few make a secret of their routine forms, and many an article has appeared, in office management magazines and elsewhere, picturing the several blank designs used by various concerns for all purposes. They serve as guides and reminders of some detail easily forgotten when one is drafting a new document blank.

That is exactly what the outgoing official had in mind. But his error was in giving the president an opportunity to preach a sermon on ethics and deprive him of memoranda which in fact would be a liability instead of an asset to his competitor if used as the president feared they would be.

—WALTER F. GILCREAS, *Cost Accountant.*

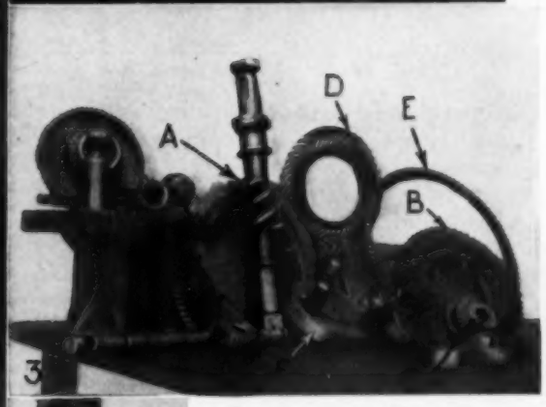
Inspection or Discretion?

When an inspector should pass judgment on material not exactly the required dimensions is dependent upon the nature of the product. In general engineering where the product is varied, much valuable time would be wasted waiting for a designer to leave his work to render a decision. The chief inspector is generally a man of experience, capable of making the fairly quick decisions which are necessary to prevent delay. He is the direct representative of the designers and has their confidence. Only where the point at issue actually affects the results aimed at does it become necessary for him to appeal to them.

—LLEWELLYN JEHU, *Chief Mechanical Inspector, Dominion Bridge Company.*

Small Shops in Europe

A. P. GWIAZDOWSKI
Assistant Professor, College of Engineering, University of Michigan



[1] A small shop, Warsaw, Poland. In this dark hole the equipment consists of two engine lathes, a universal milling machine, bench lathe, drill press, and a tool grinder

[2] The staff: manager, salesman, financier, machinist, and errand boy

[3] Made in the shop shown: (a) worm and worm gear for a five-ton truck, (b) helical bevel gear, (c) transmission gear for a four-splined shaft, (d) bevel gear with herringbone teeth, (e) starter gear, (f) die for Bakelite radio parts

[4] Also from this shop: a worm gear hob and vertical attachment. The hob is tapered and actually generates a perfect bearing for the worm

VERY few people realize the importance of a small shop. The automobile industry in these United States stimulated the growth of the small toolroom and job shop. Many production managers of the larger automobile companies benefited by suggesting to subordinates that they start a shop in their basements or their garages to make parts, special tools, or jigs and fixtures, for their erstwhile employers. This created, in many cases unconsciously, new economic forces, which immediately evolved competition. As a result of this competition, better methods of production, numerous tools, and ingenious improvements of machinery were developed.

Europe also is crowded with these small machine shops, but they are of an entirely different type. A vise, a drill press, an obsolete lathe, a handful of small tools—and these shops are ready for business. The owner of such a shop is everything, the financier, manager, salesman, machinist, and errand boy. One or two apprentices constitute the "factory labor." The owner knows that there are three indispensable elements for the proper handling of any enterprise; namely, management, capital, and properly trained men. Of course, he is "the management," and somehow he gets along without a capital. Every one appears to be paying with notes, and it takes a good manipulator and financier to earn his living.

It is difficult to understand how these small shop owners exist, but it is still more difficult to visualize the equipment and processes used in the production of dies, tools, gages, and automobile parts. The patience and ingenuity of these men are remarkable.

Even an able man, a hard worker and an ingenious mechanic, has a hard time in Europe. The social law is universal over there. A toiler always is a toiler; his children become toilers; their children will belong to that same class; and so on.

Practical Hole Tolerances

DAVID W. OVAITT

Chairman, Tool Standards Sub-Committee,
Buick Motor Company

SINCE Mr. Ovaitt's articles, "Tolerances and Tools," (Vol. 72 pages 903 and 956) were published, a number of comments have appeared in American Machinist and other periodicals. Partly in rebuttal and partly to clarify points which appear to have been misunderstood, the author now supplements his original presentation

IN A RECENT number of an automotive magazine, two well versed men (writing as co-authors on tolerance systems) called attention to the fact that two diametrically opposite systems of cylindrical hole tolerances were being discussed in the technical press. As a matter of fact, they show quite conclusively that four systems existed before a fifth or last newcomer was sponsored by General Motors.

It matters little which of the first three systems first came into being; what does matter is that it did presume to establish tolerances for both the hole and the shaft on a theoretical basis, so the engineer might have a ready reference table from which to select a fit. Undoubtedly, the first system was received favorably, and serious attempts were made to apply it. For various reasons, it could not have been entirely satisfactory, and two other systems made their appearance in an effort to overcome what then appeared to be the weaknesses of the first. Later on, W. L. Hindman, after considerable research, evolved a system which to a considerable extent offered possibilities of a more universal application than the preceding three systems.

Considering only the hole tolerances of these first four systems, their application to any given nominal size may be made by referring to Fig. 1. Systems No. 1 and 2 are commonly known as unilateral in that all the tolerances are on one side or the other of the basic line. System No. 3 is known as bilateral in that the allowed tolerance is split equally on both sides of the basic line.

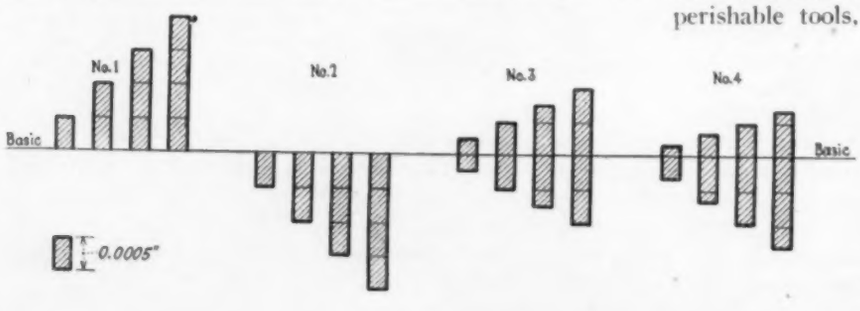


Fig. 1—Unilateral, bilateral, and uni-bilateral tolerance systems were devised to aid the engineer in selecting hole limits

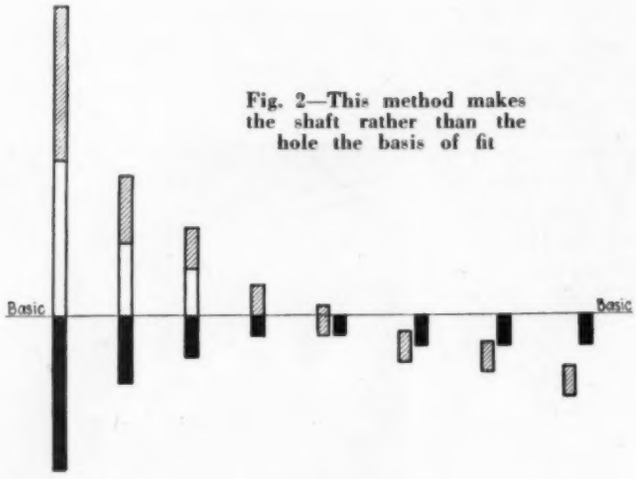


Fig. 2—This method makes the shaft rather than the hole the basis of fit

The Hindman System, No. 4, is called by the author, a uni-bilateral system. It splits the allowable working tolerance in the ratio of 1 to 3, one-third being above and two-thirds below the basic line. The system is very carefully worked out to include a wide variety of applications, the very formulas of which seem to overawe the average draftsman attempting to apply it.

Still another system, shown in Fig. 2, uses the maximum diameter of the male part, or shaft as basic and all tolerances in the minus direction. This may be applied in the variations and combinations of all the hole tolerance systems previously mentioned.

As a general rule, the machining of cylindrical holes in the quantities required by modern production is a more expensive operation than producing the shafts which are assembled therein. The majority of these holes are finished with non-adjustable tools. The maximum dimension of the tool is such that when new it will produce holes up to the high side of the tolerances established on the blue print. As the diameter of the tool wears down, it produces holes closer to the minimum blue print diameter until finally it becomes undersized and must be discarded. Such tools are known as perishable tools, and their cost is enormous.

Any standard becomes more popular if its general structure fits in with other standards used in the com-

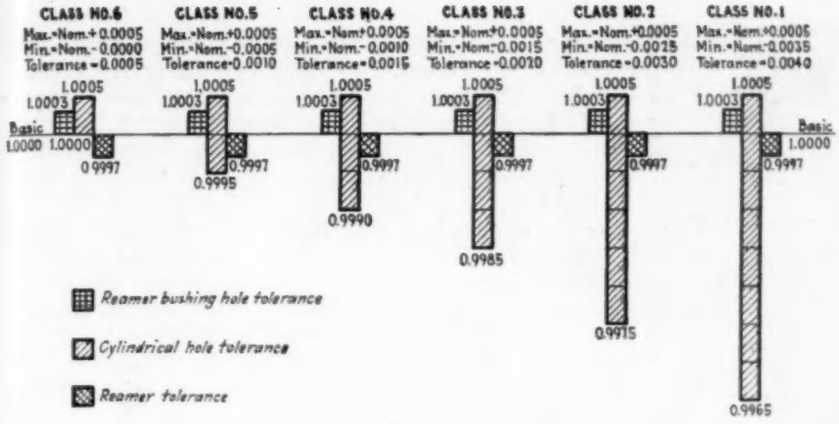


Fig. 3—The General Motors tolerance system is founded on practical tool considerations

Fig. 4—The shop works to actual dimensions and is not concerned with hole tolerence class designations

mon cause of producing the same commodity—in this case holes. Most modern engineers agree that they are not concerned if the dimensions of the mating parts vary somewhat from a theoretical basic line. They are, however, directly interested in the resultant fit and the cost of producing it.

A perusal of hole tolerances outlined in Fig. 1 reveals that System No. 2 is the only one that provides for one standard reamer which may be expected to produce holes approximating the maximum diameter in all classes. The other three systems openly invite special reamer diameters if maximum life and minimum tool cost is to be obtained. The General Motors Engineering Standards Committee adopted the system shown in Fig. 3 because:

1. It provides entirely satisfactory tolerances for all requirements of running, slip, or press fits.

2. It permits of one standard reamer to produce holes for all tolerances, should change in the class of tolerances become necessary after production starts.

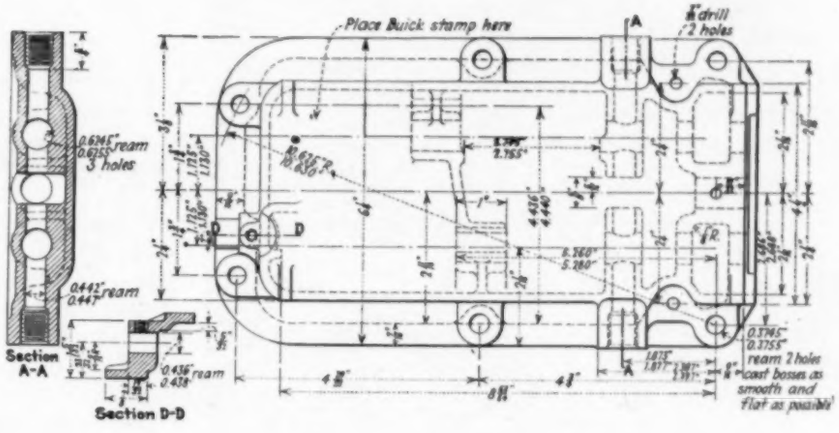
3. The structure permits standard reamers to be established which will run in standard drill jig bushings.

4. It permits reamers, worn undersize from finer classes of tolerances, to be used in the coarse classes, obtaining maximum reamer life.

5. The system, based on all maximum holes being 0.0005 in. above basic with the minimum in various classes below maximum in even 0.0005 in. steps or multiples thereof, makes it easy for the average draftsman to understand.

6. It permits the establishment of definite standards for gages—one "not go" gage for maximum holes in all classes and six "go" gages for minimum in all classes.

Authors of other systems have felt that any system to be complete must include male or shaft standards so that various fits between the hole and shaft may be selected from published charts. The General Motors Engineering Committee felt that no acceptable set of male standards could be established in relation to standard holes when length of engagement, class of fit, and kind of material were considered. The diameter of the male part may best be established to suit requirements when the layout is made. If any changes in fit are necessary during production, the male part is the one to be changed. Such a system stabilizes hole sizes and preserves the bushing, reamer, and gage standards.



The drawing for a transmission cover (Fig. 4) shows a practical application of the system covering requirements for standard $\frac{3}{8}$-, $\frac{7}{16}$-, and $\frac{5}{8}$-in. reamed holes. Drill bushings, in the sizes named, are standard for the reamers used, in the machining of these holes. Although the $\frac{3}{8}$-in. and $\frac{5}{8}$-in. holes have a Class 5 and the $\frac{7}{16}$-in. Class 2 tolerance (see Fig. 3), no mention is made of it on the drawing. Nor is any mention made of the class used in the $\frac{1}{4}$-20 and $\frac{9}{16}$-12 threaded holes although both are the National Screw Thread Commission's Class 2 tolerance. Once the tolerance has been selected by the draftsman, no further reference is necessary on the drawing. Any later change in fit of the mating parts is done by altering the dimensions of the male part which results in the minimum of tool changes necessary.

■

The Industrial Review—*Discussion*

I. MADDAUS

President, United Machine Tool Corporation

PERMIT me to compliment the author of the remarks on your Industrial Review page. I have found them very much to the point as reflecting existing conditions in the machine-tool trade.

His remarks, "Prospects are still attempting to get machines without spending money; a number of orders okayed by shop executives are now awaiting capital's signature, while capital, just back from a 'Boost Business' meeting, refuses to sign," hits the nail right on the head. In my humble opinion, it is one of the chief reasons for the existing unsatisfactory conditions.

NEW BOOKS

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PUNCHES, DIES & TOOLS FOR MANUFACTURING IN PRESSES—*By Joseph V. Woodworth. 538 pages, 5x8 in. Clothboard covers. Published by the Norman W. Henley Publishing Company. 2 West 45th St., New York, N. Y. Price $5.00.*

Mr. Woodworth's name has become so well identified with punches and dies since the publishers presented the first edition of his work that little remains to be added. In the present volume he has made free use of articles published in the different technical magazines, and his choice of applications is comprehensive. Some of the descriptions are a little vague, but the volume is not intended for the beginner. For the toolmaker or engineer who knows enough about dies to know that each job must have its own particular brand of "bugs" worked out, the book is, as it calls itself, an encyclopedia of metal-forming practice. It is copiously illustrated with cuts and fully indexed.

THE ROMANCE OF ANTI-FRICTION—*By Winfield S. Rogers, 373 Clark St., South Orange, N. J. Privately Published. 80 pages, 5 x 7⅞ in. Clothboard covers. Illustrated. Price $2.00.*

The homely philosophy of the pioneer in the ball bearing industry interwoven with his business autobiography forms the major content of this little volume. It is a tale of struggles and tribulations attendant upon the early building of anti-friction bearings and their application to the first "horseless carriages." Always very colloquial, occasionally vague and too philosophical, this volume is still one of the most interesting it has ever been our good fortune to read, a straightforward, honest, story with all the smiles and tears left in.

LIFE EXPECTANCY OF PHYSICAL PROPERTY—*By Edwin B. Kurtz, Head of Department of Electrical Engineering, University of Iowa. 205 pages, 5¾ x 8⅜ in. Bound in cloth boards. Illustrated. Published by the Ronald Press Company, 15 East 26th Street, New York, N. Y. Price $6.00.*

As indicated by its title, this book applies to machinery and equipment, the methods used by insurance companies in determining human life expectancy. Prior to this, there has been a dearth of factual data on the problem of property depreciation. Because of this lack, engineers and accountants, concerned with appraisal and evaluation, have been forced to turn to arbitrary approximations.

After discussing the general characteristics of mortality curves, the author applies them to a number of equipment records. Water-works pumps, wooden poles, incandescent lamps, car wheels, electric cables, railroad ties, and automobiles serve to exemplify this process. The compilation of mortality tables by this method entails detailed records over a long period of years. However, inspection of these results discloses that the curves may be classed into seven families or types, each of which may be represented by a mathematical equation. The application of these formulas greatly reduces the volume of data required to set up the curves, making this principle available without lengthy observation in the field.

In the concluding chapters, Professor Kurtz points out the practical application of mortality laws to property. He demonstrates how this process may be used to determine average life, probable life, and annual renewal. The volume reflects the author's fourteen years of research on the subject. It should serve as a valuable guide to those dissatisfied with the common unscientific treatment of depreciation.

MECHANICAL ENGINEERING LABORATORY PRACTICE—*By Charles E. Shoop, professor of steam engineering, University of Minnesota, and George L. Tuve, professor of mechanical engineering, Texas Technical College. Four hundred eighty-eight pages, 5½x9 in. Illustrated. Cloth board covers. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y. Price $4.00.*

This book deals with the elements of power plant machinery and the use, calibration, and theory of related measuring apparatus. Not only are the usual instruments for measuring mechanical and thermal quantities described and explained, but considerable space is devoted to oil, lubricants, and lubricating devices. Test methods for steam engines, boilers, accessories, gas engines, and refrigerating plants are included. Valuable data and tables, including specifications on lubricating oils and a table of gas expansions and equations, are contained in an appendix of about 50 pages.

COMMERCIAL SURVEY OF THE PACIFIC SOUTHWEST—*By C. R. Niklason, Domestic Commerce Division, U. S. Department of Commerce. 647 pages, 5¾x9 in. Clothboard covers. Illustrated. Published by the U. S. Government Printing Office, Washington, D. C. Price $1.85.*

This report assembles basic information affecting the distribution and marketing of commodities in the Pacific Southwest. It is one of a series, supplementing those already published on the Southeast and the New England States.

The subject is introduced by a brief historical outline of the region from the Spanish invasion to the present day. The physical factors of topography and climate are discussed in relation to business. The major industries—agriculture, forestry, mining, fisheries and manufacturing—are described in detail. The recreational resources are given in the light of their effect on tourist traffic. The population is described from a historical standpoint and in regard to the present-day racial elements. Transportation, rail and water, is covered, including the influence of the Panama Canal. The remainder of the volume gives primary trade areas and miscellaneous market data. The report is well illustrated with maps and charts.

TUBE BENDING FIXTURES

R. G. FREEMAN
Tool Engineer,
General Motors Institute of Technology

ROUND metal tubing may easily be bent, but if it is desired to maintain a uniform cross section, precautions must be taken to that end. If the tubing is intended to transmit pressure and not volume, it makes little difference how the bending is accomplished. Thousands of feet of aluminum tubing were used in air pressure tests on the dirigible *Los Angeles;* in some cases, the tube after bending was almost flat. In this particular instance it made little or no difference as the tube was only intended to transmit pressures from the external surfaces to the recording instruments.

A tube, plugged at both ends and filled with an incompressible material may be bent; theoretically, it will not collapse. The plumber inserts a coil spring of the proper diameter in a lead pipe when he wishes to bend it. Neither of these methods, however, can be used in mass production.

High grade automotive work, especially in pressure oil lines and exhaust tubing, requires a full cross-section at the bends, since the velocity of flow and quantity of fluid moving is often large. At the same time it demands a high rate of production. The bends on this work must be done with particular care, not only from the standpoint of hydraulic efficiency but also from the standpoint of appearance. Shoddy work is unacceptable on high-grade motor cars even on curves and bends of the hidden exhaust piping.

A successful fixture for bending $\frac{7}{16}$-in. brass tubing is shown in the accompanying illustrations. Incorporated in its design is the drawing principle whereby, once bent, the tube has a minimum of spring-back and no loss of cross-sectional area at the bend.

At the right, in Fig. 1, is shown a straight piece of stock and the finished part bent to an offset with two equal radii. The finished tube is as round in section at the bend as on the straight part. The material is yellow brass.

The fixture in Fig. 1 consists primarily of two semi-cylindrical laterally sliding clamp jaws *A* and their operating cam *B*, which appears on the far side of the fixture; a round-nosed pin, *C*, upon which the tube is clamped by the jaws; the circular die *D* for the first bend; the circular die *E* for the second bend; the round nosed forming tool *F*, the lever arm *G* pivoted at the center of die *E* and supporting both die *D* and tool *F*; and all supported by the body of the fixture *H*, which is conveniently held in a bench vise.

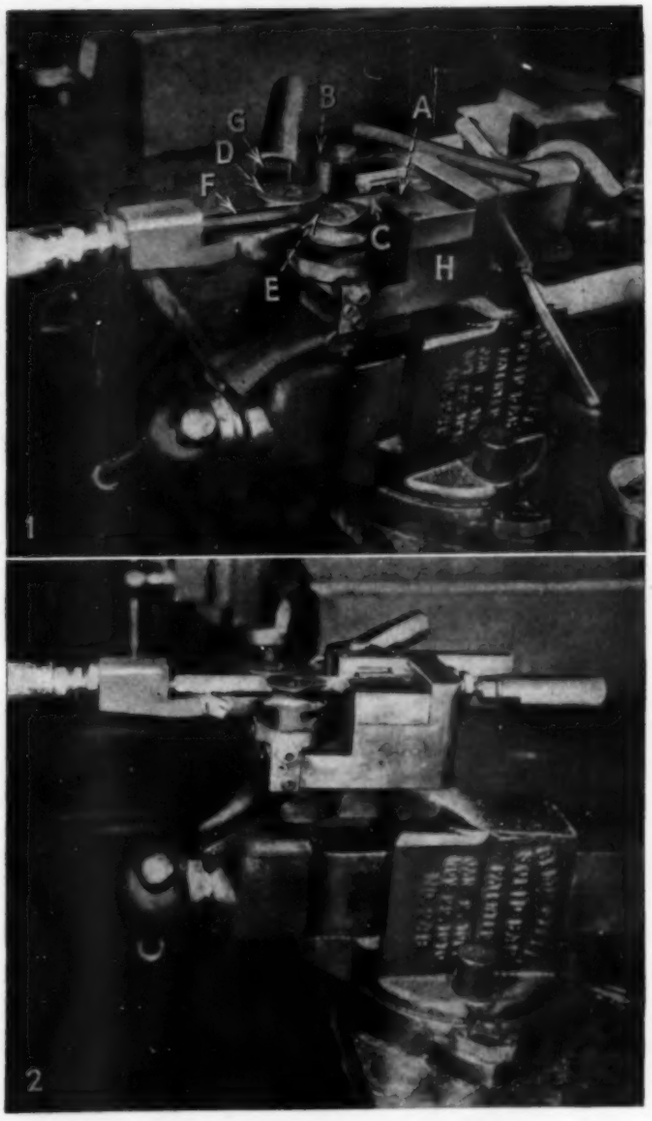


Fig. 1—Open view of bending fixture

Fig. 2—The essential features of the fixtures are outside rollers and inside mandrels

The operation is as follows: A straight piece of tubing is slipped over pin *C* until it strikes a stop on the fixture as shown in Fig. 2. The round-nosed tool, or mandrel, *F*, is run into the tube until it almost strikes the end of pin *C*. To make the bend, tool *F* is forced by hand to the left as shown in Fig. 3. To get the proper amount of turn, an adjustable stop is provided to take care of elastic differences in material. The first bend is completed as in Fig. 3. Note how the tube has pulled off the round-nosed tool *F*. The lever *G*, pivoted about the center of the second die, is now revolved to the position shown in Fig. 4. Before this can be done, the clamp is released as shown and the tube draws from

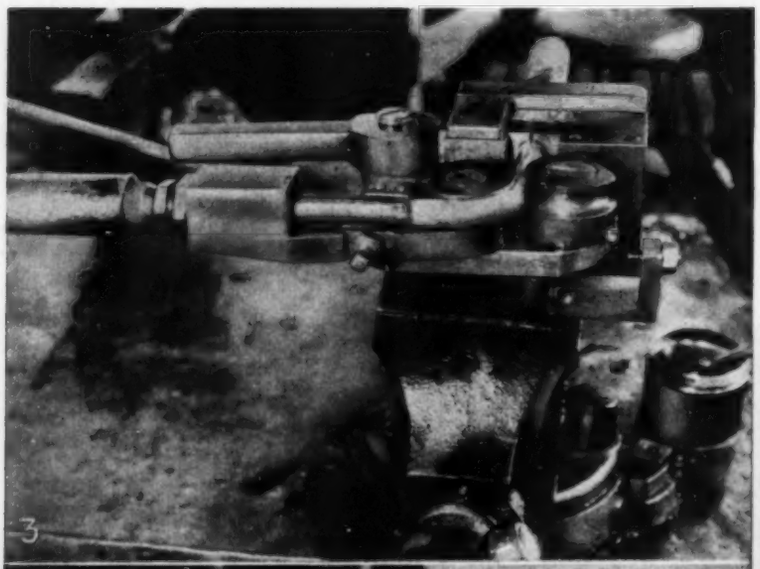
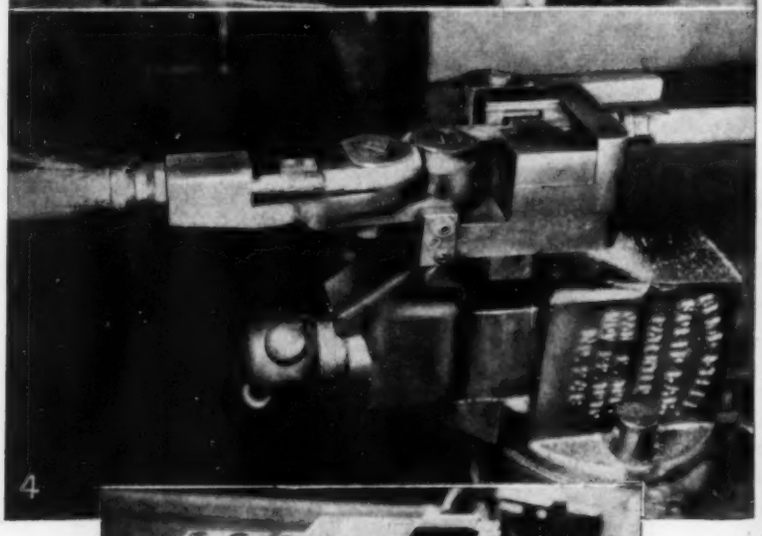


Fig. 3 — As the pipe bends it is gradually withdrawn from the mandrel

Fig. 4—A compound bend. The tip of the mandrel remains opposite the center of the formed roll



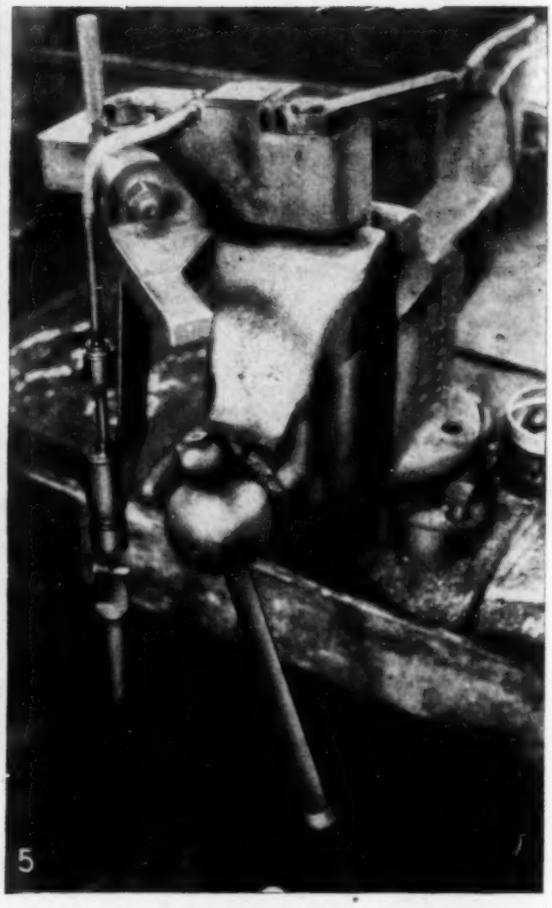


Fig. 5 — A pipe bent in two planes. A different fixture is, of course, used

Fig. 6—Putting a small kink in a pipe. This is simply bending without a mandrel, and the tube is not supported internally

the other end off round-nosed pin *C*. An adjustable stop, shown at the right in Fig. 3, limits the final motion. Form tool *F* and pin *C* are withdrawn and the bent tube is threaded from between the two circular dies.

In this design, adjustable stops must be provided to take care of the spring-back, trials being made on every fresh batch of tubing to make the setting. Hard tubing differs materially from soft, the latter always being preferred. Thickness of tubing wall also makes a difference.

To operate efficiently, the round-nosed pins should be dipped in lubricant. These pins are of hardest drill-rod, and on brass will last indefinitely.

An important point in the design is the length of these round-nosed pins with relation to the circular dies. Pin *F*, for instance, should project a short distance beyond the point of tangency with its die *D*. Pin *C* likewise must project beyond its point of tangency with *E*. Slip

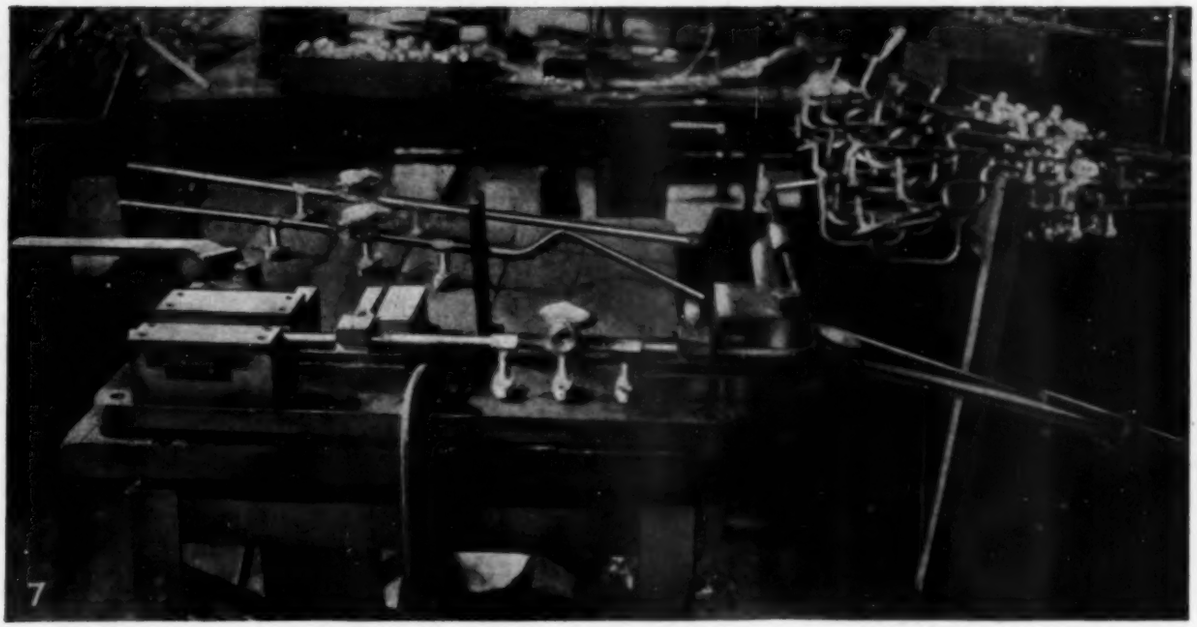
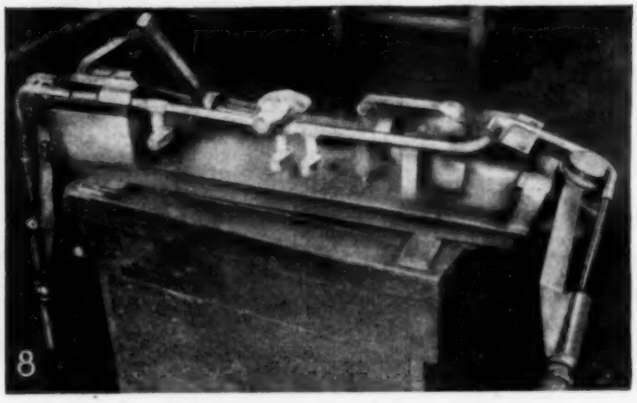


Fig. 7—Bending a complete oil line assembly for a motor crank case

Fig. 8—Still another fixture for oil line assemblies



fit of these pins into the tubing is required with about the same allowance between the outer diameter of the tube and the rounded groove in the die.

In Fig. 5 is shown a short piece of tubing bent in two planes. This fixture has all the essentials of the previous one. Fig. 6 shows a slightly different fixture in that the clamp here is performing a bending operation, a screw in conjunction with the crank shown producing the pressure required. Small twists may be safely produced in such dies, but it may be pointed out that the sections so produced will not be truly cylindrical. There is no drawing action, simply bending.

Figs. 7 and 8 show two fixtures used to bend the oil line suspended in the crank case of a large motor. The three support brackets are first assembled as shown in Fig. 3. The straight tubing is then laid in the two cam-operated cylindrically bored grips in line. The upright lever in the center actuates the two cams. A pair of cam-operated sliding dies produce a slight bend on the left end. At the right, two circular dies with accompanying round-nosed pins, supported on pivoted members, produce a dihedral offset in the tubing. The tube is removed from the fixture and is clamped in a second fixture, as shown in Fig. 8. Here final bends are given to the extreme ends. The cam grips are plainly shown in Fig. 8, as are the adjustable stops.

These bending fixtures have been in operation for several years without requiring replacements. By successive operations a tube may be produced in almost any shape without waste. By this method, with some small alterations, and by being specially powered, large thin-walled, steel tubing may be bent rapidly and economically. It is superior to straight power press bending methods with their repeated adjustments on the pressure pads, as it produces full-section bends.

Usually the problem devolves into a question of using a large section badly flattened on the bends with consequent loss of area, or a small section correctly formed throughout. Computations have shown that if a certain cross-sectional area is a requirement, the extra metal saved by using a smaller section and keeping it cylindrical from end to end will quickly pay for the proper fixtures.

Lathes of Long Ago—*Correction*

Through an error in copy submitted, the first lathe pictured on page 206, Vol. 74, was described as a model of the Blanchard lathe. W. S. Davenport, President and General Manager of the Davenport Machine Tool Company, who helped assemble the first lot of Worsley type Brown & Sharpe automatic lathes while a machinist with that company, recognized the original as the patent office model of the Worsley type machine.

This machine has an interesting history. L. D. Burlingame, of the Brown & Sharpe Manufacturing Company, writes that it is the forerunner of the present Brown & Sharpe line of screw machines, and was the first completely automatic design. Samuel L. Worsley developed it for the company in the early eighties, and it was patented in the name of the inventor in the manufacturing countries of the world. Many features of its design are in use in machines now being built, according to Prof. Joseph W. Roe of the Museum of Science and Industry in the City of New York.

The Foreman's Round Table

WIDE OPEN

"SAY, Al," hailed Ed, as the two met as usual on the way home, "What are the carpenters working at over in your department? Someone told me they were adding a sun porch to your office."

"Sun porch is right. We foremen are all going in for the wide open spaces, where men are men, and foremen are whatever they are."

"What do you mean? That we are going to have bigger offices? Mine is all right now, but I would like a rug."

"You mean a cuspidor. A rug will hide cigar ashes, but not cigarette butts."

"Thanks, I don't smoke in my office—much. But seriously, Al, what are the carpenters doing? If they are going to refinish the offices I'd like to brace Williams for some new furniture."

"You'll get some new furniture without asking for it, big boy. It may not be new, exactly, but it will be remade and refinished."

"What are you smiling at? What's the joke? I might have known that anything given to a foreman would have a catch to it. And you are just about as informative as a witness in a prohibition case. Come across."

"Well, Mr. Curious, Williams has decided that closed offices, at least as far as we foremen are concerned, are bad for the health and cause physical and mental sluggishness. Therefore all foremen's offices will be in the open shop with no other enclosure than a rail coming not over six inches above the top of his desk."

"I see. Damned if I don't think Joe Cook is right. All the men in power seem to want to do is to oppress those under them. They stopped the foremen driving the men, which he never did anyway, and ever since they have been driving the foremen. And you laugh at it. I don't know, Al, sometimes I don't know what to make of you. I know you're not a sucker or a snitch, or I would have lost my job long ago, the things I've said and done, but you sure do get my goat sometimes. The thing that makes a pessimist like me, is having to live with an optimist like you."

"The trouble with you, Ed, is that you are short on imagination and long on apprehension. Williams is doing this to help the foremen."

"Yes, help them out of the office. He tries all kinds of stunts to let the man at the machine sit down, and now he has a scheme to keep foremen on their feet. I'm disgusted."

"Off half-cocked as usual. What Williams wants is to keep a foreman on his toes, not his feet. These offices are going to be built at the back of the shop and elevated one step. All roll top desks will be done away with and no pigeon holes allowed. The foreman is expected to spend most of his time there. The effect on discipline is better because every one has his back toward the office, and when the foreman looks up he is right out in the shop."

"That sounds all right, but——".

"But, I'll beat you to it. Williams is doing away with roll tops and pigeon holes so a foreman can see and because it will make him take care of things promptly. Now he shoves it in a pigeon hole, takes a walk around the shop—and forgets it. I bet I can find notes in your desk that you never answered."

"No you can't. But I got a lot of other things."

"Yes, and you will have a file cabinet for them, and it will have a good lock on and so will your desk. In fact, you will have everything you need—except a rug."

Is the contemplated change beneficial to the foreman? Should the foreman's desk be at the rear where he can see or at the front where he can be seen? Are there any other benefits or disadvantages?

▸ ▸ ▸ Discussion of Former Topics

End of the Road

It is the duty of every progressive organization to offer its employees unlimited opportunities for advancement.

The organization that fails to do this is a detriment to the community, in that it breeds anarchy and bolshevism. For without the incentive of advancement, the ambitious man will not stay; the other kind you do not want.

If, as a man is advanced, he is told what studies to pursue, it is doubtful if you will ever have to tell him he has reached his limit. If he fails to broaden with his position, the best thing to do is to advise him to seek employment elsewhere. "A standing train only blocks the track."

The foreman, if he has the interest of the employees and his employers at heart, will know not only who, but when, a certain man is ready for advancement.

—Leon F. Shaffert, *Division Chief, Western Electric Company, Inc.*

Check and Double Check

This problem gives a lot of small shops trouble. Keeping a multiplicity of tools about will not pay if they are not in continual use. Even big firms have the same trouble, for, if they possess two of everything, at times they will require three. I have noticed that the principal cause of difficulty is that, while one man may need, say, a "mike" continuously, others only need it intermittently. My remedy is to let the man who is using it continually have a tool out on his check but make him understand that he must be prepared to lend it for short periods. The tool should be returned promptly by the borrowing workman. The reason men do not like lending tools is because it is so difficult to get them back.

—W. E. Warner, *Herts, England.*

The Fortune Teller

Psychology, as commonly understood, is a study of mental activities and states. The proposed psychology test is, then, a method of experimentation carried out in order to draw conclusions regarding the mentality of the possible new man.

Allowing that the foreman can best ask the detailed questions regarding the skill of the men and judge the replies, it is not at all certain that the foreman can, even then, pick the best men, in the company's wider point of view. The average foreman is not to be compared with the centralized personnel or employment department as regards the selection of workers.

The tests, which it is proposed should be carried out on applicants for employment, may differ considerably in character. Intelligence tests may be of assistance in giving some indication of mental quickness and general knowledge, but it is essential that the executives of the company realize that the results obtained cannot alone be used as a test of fitness for specific jobs. Such tests form, at the most, only another instrument in the hands of the company to gage the type, character, and ability of possible new men.

—S. A. Knight, *Tuz Khurmatu, Irak.*

The Exception to the Rule

The cutting of rates borders on the unethical and is always poor practice. The only way to avoid this trouble is to set rates that are correct. This requires either time study with a speed factor for the efforts of the workman while being timed, or the compiling of a rate from known factors. In either case the amount of work to be done and the quality required must be available.

The earning powers of men vary widely, and their earnings should follow. This principle is applied to brain workers: it is but fair for all workers. One exceptional man I observed in a production shop justified his earnings by offering repeatedly to take a cut if anybody else could equal his performance. He could average from ten to twenty-five per cent more than any other man.

At least one well-known system sets rates that are fair to all concerned. When a workman is to be time-studied, a preliminary survey of the working conditions is made. This includes correct machine settings, location of boxes or containers, proper tools and gages, and assurance that the work is satisfactory. A detail study is then made covering enough pieces to give conclusive results.

This much is common to many plants but the coding of the workman's speed is not always understood. Coding is the assigning of a numerical differential factor to the speed of the workman during the study. This makes it possible to set correct rates regardless of the man observed or the speed attained.

Good coding requires a good knowledge of the work being done and a keen judgment of what constitutes a good performance. Errors will creep in, but when this is plainly the case, readjustments do not cause difficulties.

—L. F. Swenson.

A Friend at Court

If Ed is half the man he has shown himself to be in his discussions with Al, I can't see how he is storing up grief for himself. The man who is holding down a job that is too big for him will soon come a cropper, whether he eliminates all direct competition or not. Ed can take in a good man, friend or no, with perfect assurance, provided he has the good judgment not to let that friendship enter the shop door. A good executive never lets his social activity or personal feelings enter his shop or

office. If the friend in question is not big enough to recognize this, he should be set straight at the very first indication, not after it has become a habit.

I don't believe Williams can be expected to veto the proposition as against good shop management, for if he has the faith in Ed he has exhibited in the past, he will have confidence in Ed's ability to keep the situation in hand

As to the friend, I do not believe he is submitting himself to a handicap, unless he deliberately chooses to make it such by presuming on the personal friendship. If he'll hold his head, and realize that business and friendship should be kept separated, each in its proper time and place, he has nothing to fear. In fact, if he has the sense to realize the possibilities of things going wrong under certain circumstances, the battle is won, for he holds the key to that situation in his own conduct and attitude. —BERNARD F. MCCORMACK.

Who's Who in Industry

In the production of overhead conveying chains, the links were assembled by means of bolts and pins approximately $\frac{5}{8}$ in. in diameter by 4 in. long. The bolt had parallel flat sides about $\frac{3}{4}$ in. long and $\frac{3}{8}$ in. wide. The pins had this operation on each end. An ordinary-type fixture, straddle mills, and a manufacturing miller handled this job quite satisfactorily. One of the die makers suggested, and persisted in his suggestion that he be permitted to build a cheap die to handle this operation. He finally was given permission, built a die at little cost, and both ends of the pin were sheared simultaneously at a sustained rate of 700 per hour. As I recall it the operator increased his output four to five times.

In a manufacturing plant building small motors, the stator blanks were made from strip metal on a progressive die. The rotor blanks were made on a compound die from the center blanks of the stator.

Through the same die maker's persistence, these tools were also improved, building up the average run per grind from 30,000 to over 200,000 pieces. That seemed final. But no! By working in close co-operation with the designer, a combined compound and progressive type die was built which produced both blanks at the same time, and stacked them, at the rate of 6,000 each per hour. Grouping the increased die production and the elimination of girls stacking blanks, one operator now does the work of six to eight as previously run.

In a plant engaged in the manufacture of gears, pulleys, bearings, etc., standard sizes of bronze bearings were made in large quantities. Boring and reaming cast bronze bearings in the screw machine was apparently profitable and satisfactory. Another of those persistent die makers, and the bore of these small type bearings is now broached and shaved in a press. The output increased from eight to ten times its former rate.

Not so long ago the ordinary automobile fender was formed in a series of operations, whereas now, one stroke of a powerful toggle press, and the whole form is made. Automobile doors, side panels and rear ends, even to the drawing of the window sills are drawn in one operation. One stroke of a mighty press and one operator can do the work of twenty men of but a short time ago. Does anyone suppose the operator suggested, designed, or built these master tools, or does anyone suppose the operator is responsible for this economic production!

I fail utterly to see why or how anyone can advocate or justify paying machine operators and skilled men the same stipend on the plea that the operator produces more material. I wonder if any of those who advocate it are familiar with deep drawing of shells. If so, what would he do if he were manager of a plant and found his polishing and buffing costs materially reduced because a die maker had done the seemingly impossible in eliminating the ridges or rings caused by redrawing. Would he recognize the skill and thought required, or would he again increase the operator's rate because he was producing more and better shells?

Years ago I worked in a die room and one of the boys was given a complicated die to make. After getting into the design he reported to the foreman that the die would not function, and as designed he would not care to build it. You have all met these wise foremen who are afraid to discuss a problem lest they show their lack of knowledge, and hide behind their authority. He was such, and gave the tool maker orders to build what he was told. This man quit rather than build this useless tool, for such it proved to be.

I speak of this only to bring out the sense of responsibility a real mechanic feels for the product of his skill. Does anyone believe the die maker's day is over when the whistle blows? The first six to ten years of any capable die maker's experience are years of hopes and fears. He looks up reference books at home, gets information from older men, goes to night school, keeps in touch with live magazines, and wonders if the die he is making will come out right.

Naturally, as his experience grows, so does his ability and confidence. But there is a responsibility, a sense of moral obligation as well as of exacting requirements, in the making of intricate and expensive tools. There are many elements, wherein a slight error or lack of knowledge means a loss of hundreds of dollars, and to their credit, die makers as a rule carry this responsibility with concern as great as though their personal money were at stake.

So much for these few instances.

As to the physical labor: it is true that some die makers get a break here, but the mental strain and exactitude is much more tiring, physically and mentally than manual labor. See them set up, try out, make corrections, and re-try, grind, chip, and file these huge tools and again set them up in five-hundred-ton presses. Remember, too, this grinding has to be done to arrive at results as concluded from a previous trial. It is not so many thousandths to bring it to size measurement; ability to measure to tenths does not count here, only judgment.

This is die knowledge that many never get, some get fairly well, and in which a very few excel.

I can recall hundreds of incidents from personal experience that in my opinion make the assertion of a wage ratio favoring the operator look as absurd to any fair minded person as it looks to a mechanic. Using the system, I presume the janitor and general manager should receive the same rate, for neither of them is turning out much work and therefore not earning money for the company.

When anyone says the drop forger is entitled to as much or even more than the old blacksmith, I have my own opinion and am content to let it go at that, but when he includes the die maker in his field, I object.

—JOHN J. MCHENRY.

ACCURACY IN GEAR GAGING

J. A. POTTER
Chief Draftsman, Singer Manufacturing Company

A REVIEW of measuring devices now in use, with several new suggestions

POSSIBLY some historian knows when gears were originated. And if he could tell their whole history up to the present time, he might very probably say that the greatest advance has been in the last 30 years. It has been a pleasure to follow Earle Buckingham's articles, which have done much to increase interest in gearing. There are plenty of formulas for the design of gearing and a number of gages for setting the cutters to depth when machining, but very little attention has been paid to the measurement of gears for accuracy.

Consider a pair of spur gears located on two studs on a block. The studs are spaced the same distance apart as the shafts in the machine on which the gears are to be used. This arrangement, which is familiarly known as a run-around gage, is shown in Fig. 1. It can be elaborated in design by using interchangeable studs of different diameters, mounted on adjustable slides, so that a range of center distances may be obtained between the studs, permitting the use of this device for gears varying in pitch, diameter, and bore. This gage will tell just one thing—whether the gears, when assembled at their proper center distance, will mesh and revolve. It may be found that they run hard at one or more points, and the teeth at these points may be chalked and fitted; yet the gage does not show how much fitting will be required. Nor does it show what caused the variation, nor what the effect would be if the gears were run under a load at a high speed.

It will be conceded by gear manufacturers that the tooth form and its position in relation to the shaft are the principal working considerations in a gear. So why not measure for both? In 1916, *American Machinist* published one of my articles giving a formula for calculating the diameter of a plug to be held at the pitch line and measured from the bore of a spud gear by a vernier caliper. This process was, of course, tedious, but it showed that a difference of 0.001 in. caused considerable noise at high speed. With the spur gears, the plug lies parallel with the shaft; but beve and helical gears present different conditions.

With a speed of 5,000 r.p.m., it is desirable that the contact at the pressure angle be equidistant on all teeth in relation to the bore for both spur and helical gears, and in relation to the bore and the seat of the hub for bevel gears. A simple gage for bevel gears, employing a dial indicator, is shown in Fig. 2. The gear to be tested is located on the shaft and is held in position by a setscrew. If the gear has no setscrew, plungers or gibs can be used to hold it against the shoulder on the shaft. The shaft is put into the gage, and when the end *B* contacts with the adjustable screw, *C*, readings may be taken on the dial indicator. Note that the indicator is attached to a bracket having plugs 5 in. apart, the same as in a sine-bar, so it may be set angularly with accuracy. The bracket is adjustable vertically on a tongue to accommodate larger or smaller gears. The gage can be further elaborated by providing interchangeable bushings for various sizes of bores. A ball point may be used on the indicator spindle, but a cone point is preferable. A cone having its sides perpendicular to the line of contact can be worked out by using the formula given in Fig. 5. From this formula, it will be noted that the cone-contact angle varies with the number of teeth in the gear only, regardless of the pitch diameter or the diametral pitch.

The manufacturers of cutters for gears keep to a high standard regarding tooth form, and evidently have their

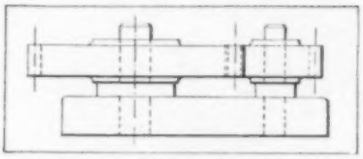


Fig. 1—Only a limited amount of information is obtained from the familiar method of testing gears on studs

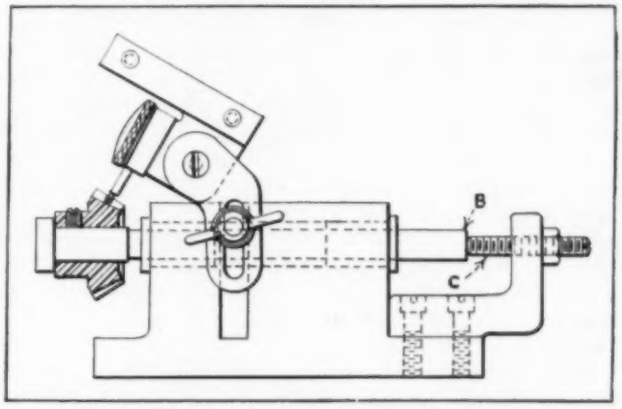


Fig. 2—This bevel gear measuring device uses a dial indicator with sine-bar angle adjustment

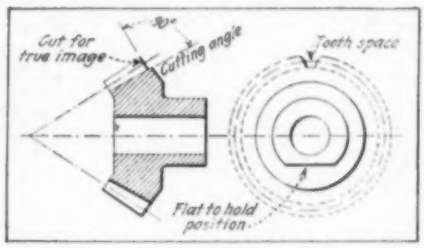


Fig. 3—In the optical inspection of bevel gear teeth, care must be taken to project a view normal to the line of cut

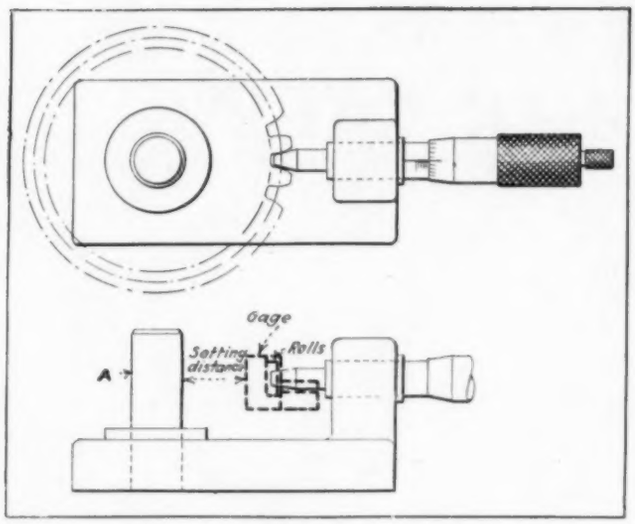


Fig. 4—A micrometer may be used to determine positively the tooth depth at the pitch line

own methods of master gaging to maintain that quality. However, cutters will wear, but their form at the points of contact may easily be tested by optical measuring machines of either the direct-observation, or the prismatic types. The image of the form is greatly enlarged and may be projected on a sensitive plate or traced directly. Reversing the tracing and superimposing it on the original will show whether both sides are uniform. Gears may also be inspected by this method. A bevel gear will, of course, have to be held at an angle of cut and have the back slabbed off, as in Fig. 3, so that the correct image can be projected.

It is obvious that while the gage in Fig. 2 will show whether the contact points are in the same relative position to the shaft, it will not show this distance in relation to the pitch line. A gage for obtaining positive measurements using a micrometer head is shown in Fig. 4. Note that the end of the spindle is cone-shaped and that it engages the gear as a tangent on each tooth profile at a predetermined depth, thus providing for measurement in relation to the shaft regardless of the outside diameter of the gear. It would appear that there might be con-

Fig. 5—An auxiliary set gage determines the initial position of the micrometer cone point

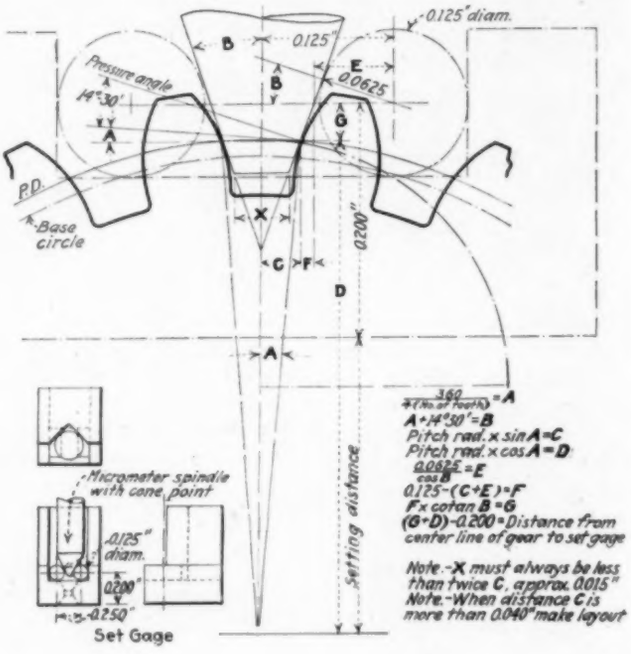
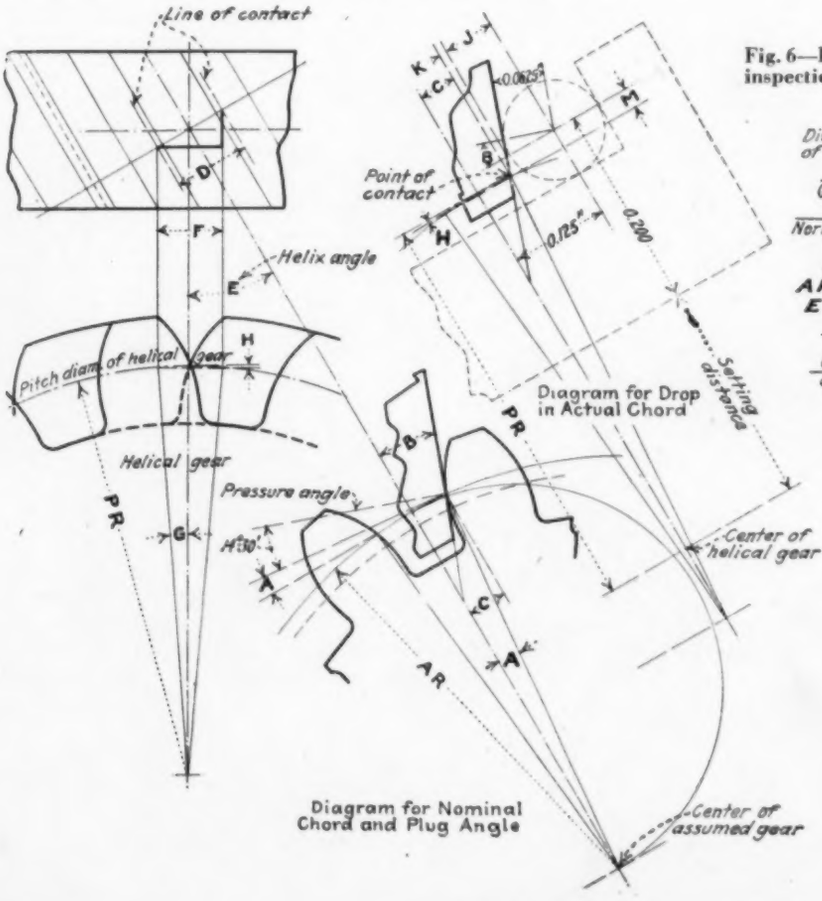


Fig. 6—Helical gears are subject to the method of inspection shown in Fig. 4 by suitable computation



Divide the number of teeth in helical gear by the cube of the cosine of the helical angle

$\frac{N}{(\cos E)^3}$ = Number of teeth in assumed gear = N

$\frac{N}{\text{Normal pitch}}$ 0.5 = Assumed radius = AR

$\frac{360}{4N}$ = Assumed angle = A A + 14°30' = B

AR × sin A = C 2C = D

E = Helix angle D × cos E = F

$\frac{0.5F}{PR}$ = sin G PR − (PR cos G) = H

$\frac{0.0625}{\cos B}$ = J 0.125 − (C + J) = K K × cotan B = M

(PR − H) − (0.200" − M) = Setting distance

Note.—When distance C is more than 0.040" make layout of taper plug and setting gage

Note.—Bottom of taper plug must be less than twice C, approx. 0.015"

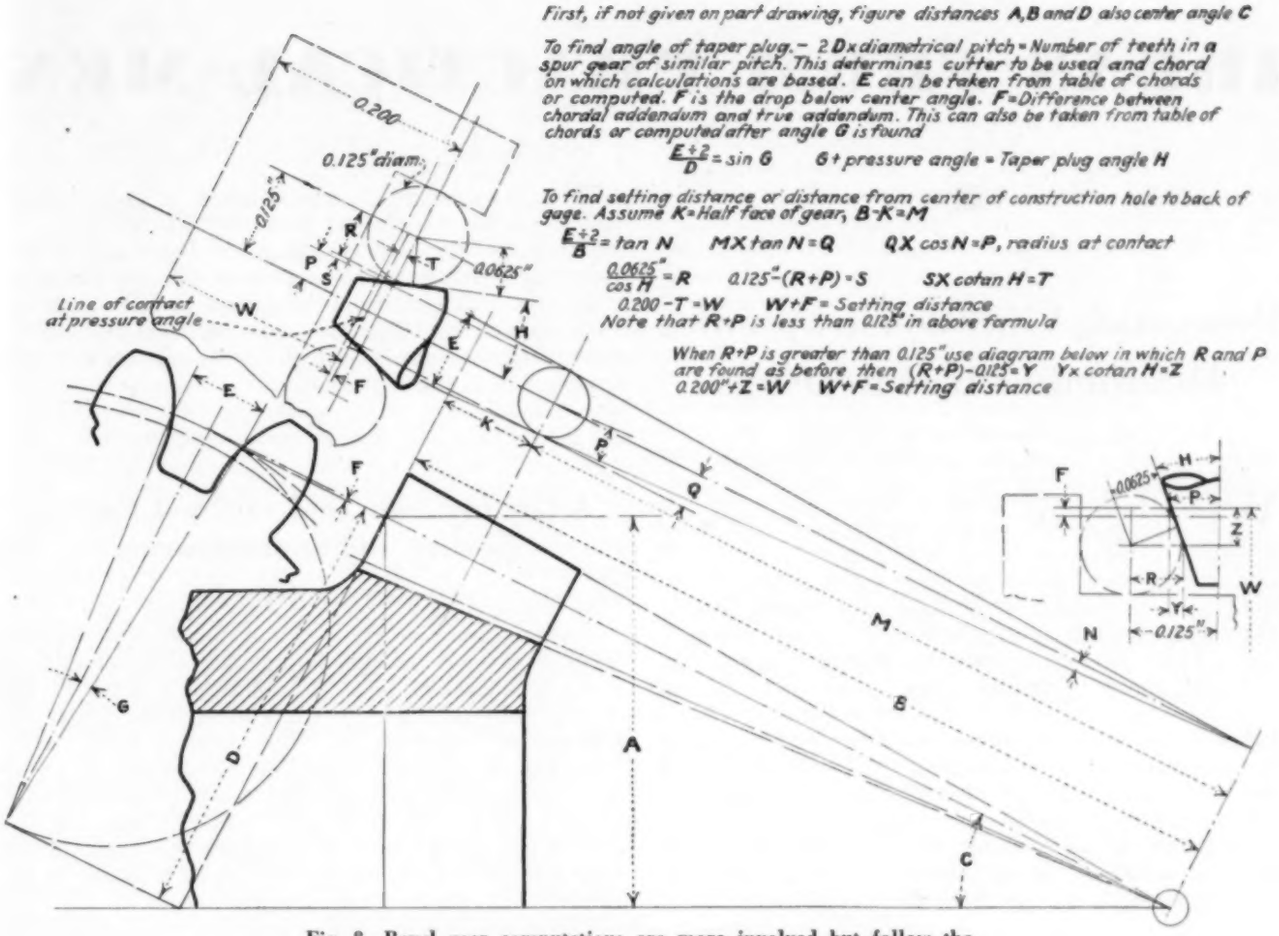

First, if not given on part drawing, figure distances A,B and D also center angle C
To find angle of taper plug.– 2D x diametrical pitch = Number of teeth in a spur gear of similar pitch. This determines cutter to be used and chord on which calculations are based. E can be taken from table of chords or computed. F is the drop below center angle. F=Difference between chordal addendum and true addendum. This can also be taken from table of chords or computed after angle G is found
E+2/D = sin G G + pressure angle = Taper plug angle H
To find setting distance or distance from center of construction hole to back of gage. Assume K=Half face of gear, B-K=M
E+2/B = tan N MX tan N = Q QX cos N = P, radius at contact
0.0625"/cos H = R 0.125"-(R+P) = S SX cotan H = T
0.200 - T = W W+F = Setting distance
Note that R+P is less than 0.125" in above formula
When R+P is greater than 0.125" use diagram below in which R and P are found as before then (R+P)-0.125 = Y Y x cotan H = Z
0.200"+Z = W W+F = Setting distance
0.200
0.125" diam.
0.125"
0.0625"
Line of contact at pressure angle
W
R
P
S
T
H
E
F
K
Q
M
N
B
A
C
G
D
Z
Y
0.125"

Fig. 8—Bevel gear computations are more involved but follow the same principle. A construction hole provides the point of departure

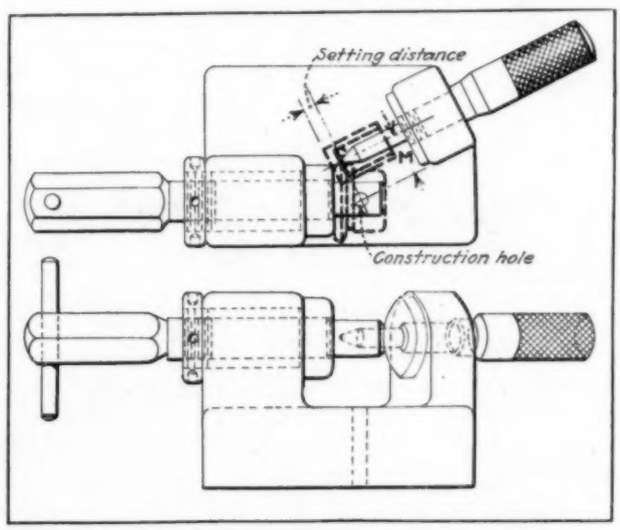


Fig. 7—The micrometer gage principle adapted for use on bevel gears

siderable difficulty in setting the micrometer for this gage, but a small auxiliary gage can be made for this purpose.

This gage consists of a block containing two steel rolls of proper diameter and center distance to contact the spindle cone at the correct theoretical distance from the gear center. After the cone angle has been determined as in Fig. 5, a reasonable roll diameter and block thickness is arbitrarily assumed. From these dimensions, the setting distance from the back of the gage to the gear center may be computed as shown. In setting the gage, half the arbor diameter is deducted from this distance and size blocks equal to the remainder are placed between the arbor and auxiliary gage. The micrometer spindle is brought into contact with the rolls and adjusted so it reads an even figure such as zero, 0.250, or 0.500. This setting then represents the calculated micrometer reading when in contact with a theoretically correct gear. Variations from this reading are noted with the gear in place.

Helical gears may be measured in exactly the same way though the computations for determining the initial gage setting are naturally somewhat more complicated. These are clearly shown in Fig. 6.

For bevel gears the method must be modified. A gage fixture shown in Fig. 7 is employed which uses a construction hole to set the micrometer. Fig. 8 shows the mathematics required to obtain the location of the micrometer point for a theoretically correct gear. The micrometer axis is set at right angles to the center angle of the gear at a distance M from the cone apex. An auxiliary gage, similar to that used for spur and helical gears, is set at the computed distance from the construction hole. The micrometer spindle set to this gage is at the correct zero reading.

The micrometer method of gaging as described for spur, helical, and bevel gears, differs from most other methods in that it does more than compare tooth profiles for a given gear. It is based on the true gear form and definitely measures variations from this standard.

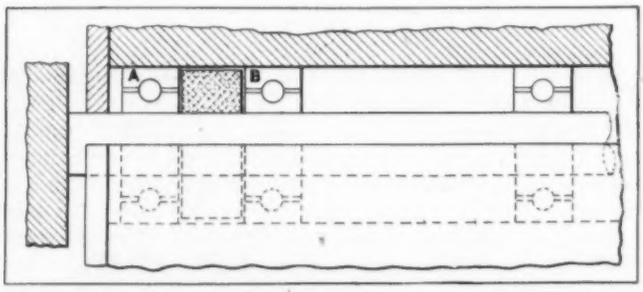
IDEAS FROM PRACTICAL MEN

Preventing Vibration in Spindles Mounted in Ball Bearings

HARRY SHAW (G.M.I.P.E.)
Milnrow, England

WITH THE introduction of special alloys for cutting tools, higher cutting speeds have been made possible. Whether or not it would be advisable in all cases to use high cutting speeds is a matter that I consider very doubtful, for it has been proved that if material is removed at very high speeds, a stress is produced in the surface crystals that will lead to ruptures or cracks, and so to ultimate failure of the part. Be this as it may, higher spindle speeds are being provided on lathes and other metal-cutting machines, and as one of the essential points in a spindle is freedom from friction and heat when running, various designs of spindle bearings have been evolved.

Attempts, some successful, others not, have been made to mount lathe spindles in both ball and roller bearings. From the results of such attempts it would appear that



it is rather difficult to eliminate a slight freedom of the spindles in the bearings, which gives rise to chatter. In grinding machines having wheel spindles mounted in ball bearings, this trouble seems to be particularly present, producing very slight ripples on the surface ground; ripples that are, however, admittedly very shallow.

A special grinding machine having its wheel spindle mounted in ball bearings was cured from chattering in a rather novel way. The front end of the spindle was mounted in two ball bearings *A* and *B*, while the rear end was mounted in a single ball bearing. A phosphor-bronze bushing that was a sliding fit on the spindle was placed between the two front bearings, the clearance all around the bushing being about 0.001 in. The spaces around the bearings and the bushing were packed tightly with grease, no provision being made for other lubrication. The grease was prevented from coming out by close-fitting covers at the ends of the spindle mounting. If grease-gun lubrication had been provided for, the probability is that someone would remove the grease-hole cap and leave it off for a little while, allowing dust to enter the bearings.

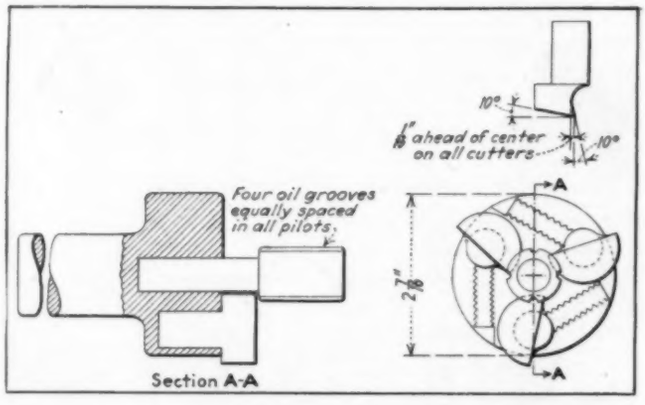
The grease-packed bearings acted as a vibration damper on the spindle and prevented chatter marks in the work, but the friction loss in the bearings was not materially increased. This method of damping vibration is one that could, no doubt, be applied to other types of machines, for the full value of the idea was realized by having run the machine both with and without the bushing.

A Combination Tool for Spot Facing, Boring, and Counterboring

GEORGE R. BOWE, JR.

A cheap, practical, efficient, and durable tool that can be used for spot facing, boring, and counterboring is shown in the illustration. It consists of a shank having an enlarged head, three inserted cutters, three screws for holding and adjusting the cutters, and a pilot. After loosening the holding screws, the cutters can be set to any diameter within the range of the tool by partly rotating them. The three-point cutting edges make a smooth cut and leave a fine finish on the work. When used for spot facing, the cutters can be adjusted to the correct angle of shear for different metals.

The cutters can be made of any kind of steel to suit a

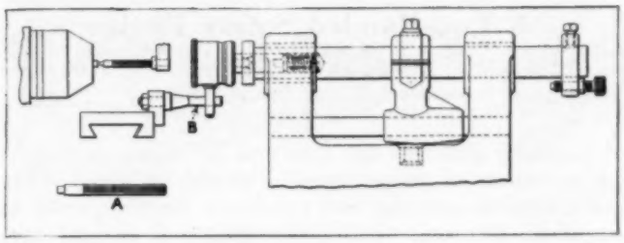


particular job, and can be quickly changed for others. The tool can be made of any desired size at a low cost. When the tool is used for spot facing or boring, the removable pilot can be left off.

High-Speed Threading on Automatics

W. L. WATERHOUSE
Smethwick, England

The set-up on a three-operation automatic, as shown in the illustration, for the production of the threaded brass part *A*, is an example of how high output can be obtained from a simple tool equipment on an inexpensive



machine. The material used is extruded brass rod of the correct diameter for the threading operation. The stock is fed to a stop, which is quickly withdrawn. The self-opening die-head, fitted in a spring holder, is then advanced by the cam on the drum, the die-head being set so that sufficient compression is obtained on the spring to start the die on the work. The cam on the drum is used only for starting die-head, and does not control the travel of the sliding rod on which the die-head is mounted, the rod being drawn along with the die-head as the threading proceeds. The sliding rod being light and a free fit in its bearings, there is no tendency to cause error in the pitch of the threads.

Upon completion of the threading operation, the travel of the sliding rod is arrested by the stop collar at the rear, causing the die-head to open. The return cam on the drum then returns the sliding rod to the starting position. The toolblock on the front cross-slide is then advanced and the tool forms the reduced portion on the end of the work, being quickly followed by the toolblock on the rear slide, carrying the cut-off tool. Closing the die-head is effected by means of the cross-bar *B* attached to the toolblock on the rear slide, this operation being done at the same time that the piece is cut off.

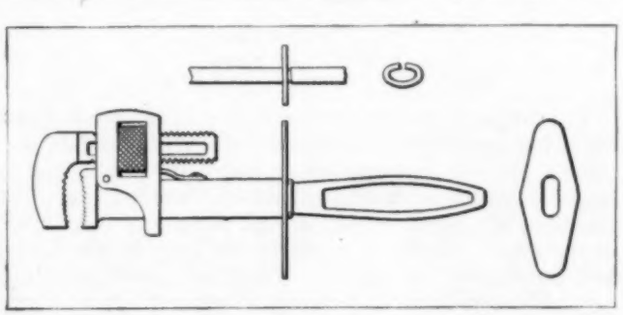
One spindle-speed only, 2,500 r.p.m., is used for both the turning and the threading operations, this speed being the maximum obtainable on the machine. The production time for the job was four seconds per piece. The chasers stood up for long periods without regrinding.

■

Safety Guards for Wrenches and Cold Chisels

JOSEPH M. O'DROBINOK
Machinist, Standard Oil Company, Whiting plant

Since I am interested in all new kinks, especially those that make work safer, I am submitting the following: As a measure of safety, if users of Stillson wrenches will put a steel guard of the shape shown in the sketch over the handle of the wrench and hold it in place by a wire ring, it will save their fingers from being bruised, or mashed, if the wrench should slip. As the guard is oblong, it can be turned so as not to interfere when using the wrench in close quarters. Of course, this method of holding the guard applies only to wrenches having metal handles.



For wrenches having wooden handles, the handle can be taken off and the guard can be slipped over the tang and against the shoulder of the shank. When the handle is replaced and the nut screwed on, the guard will be clamped between the shoulder on the shank and the ferrule on the handle. Monkey wrenches can be safeguarded in the same way.

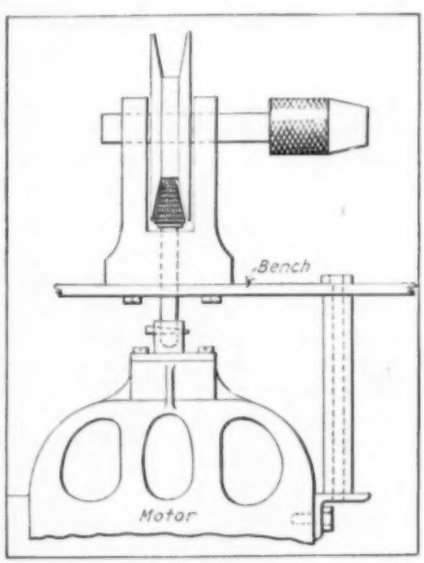
The same means of safety can be applied to cold chisels by grinding the end round for an inch or so under the head, and grinding a groove for a wire ring to retain the guard, as shown in the sketch. The guard can be a disk of steel or a larger washer. If the head of the chisel is missed by the hammer, the hammer will strike the guard and save the knuckles from being bruised. One advantage of this method of protection is that when the heads of chisels are mushroomed from continued use, the mushroom must be ground away before the guard can be applied. Since chisels having mushroomed heads are an inherent source of danger, removing the mushroom is a precautionary measure.

■

Friction-Drive Tapping Machine

JOHN A. DICK
Eton, England

During the course of production, we often find it necessary to retap some of the holes in our work. Not having a tapping machine, we devised and built the small and very simple one shown in the illustration.



The pulley has a V-groove, the sides of which converge toward the center, and there is a certain amount of side play between the bearings. Fitting the groove in the pulley is the small, cone-shaped friction wheel, made by stringing and compressing leather washers on the vertical drive shaft attached to a motor beneath the bench.

The drive shaft is of such length as to keep the friction wheel out of engagement with the groove in the pulley. In operation, with a tap in the chuck, pushing the work on the tap forces back the spindle and the pulley, bringing one side of the groove into engagement with the friction wheel, thus setting the

spindle in motion. When the tap has been run into the work the proper depth, pulling the work forward brings the opposite face of the groove in the pulley into engagement with the friction wheel, reversing the direction of the spindle and backing out the tap.

Not wanting to go to the expense of making patterns for the machine, the parts that would ordinarily be cast were made from steel. The bearings for the spindle and the drive shaft are bronze bushings.

■

Counteracting the Index Error of Turrets—*Discussion*

R. GRANT
Bausch & Lomb Optical Company

Referring to the article by Gordon Tolley, under the title given above, on page 894, Vol. 73, of the *American Machinist*, I desire to raise a question concerning that ancient stunt of placing a boring bar in the turret so that the cutter will be vertical instead of horizontal, to offset the variation in the size of holes due to inaccuracy of turret indexing.

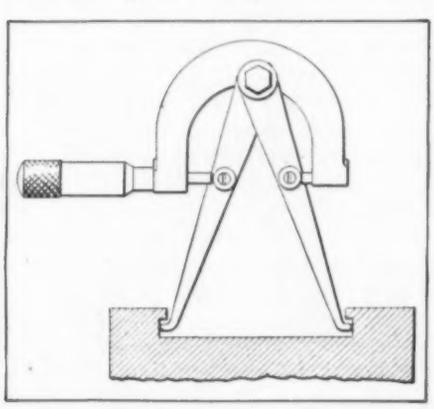
If the spindle and the turret slide fit closely, I would suppose that the only effect of inaccuracy in the turret indexing would be a variation in the size of the holes bored, providing the boring bar was not piloted. If the end of the boring bar is piloted in the spindle, or in a bushing held in the spindle, the holes would vary less in size, but would be slightly taper. But how can inaccuracy of turret indexing produce holes that are out of round?

■

Measuring Annular Grooves

CHARLES KUGLER

Generally it is impossible to measure the diameter of an annular groove, unless one has a pair of transfer calipers at hand. Even then the accuracy of the measurement is dependent upon the fit of the locking device.



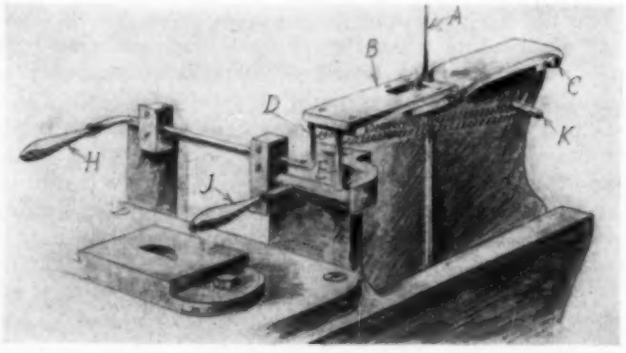
If a pair of ordinary calipers is fitted with toolmaker's buttons, as shown in the illustration, an accurate measurement of an annular groove can easily be made. When the groove has been calipered, the measurement over the buttons is made by a micrometer. The calipers are then removed and are again set so that the distance over the buttons is the same as before, using the micrometer as a gage. It is then an easy matter to measure over the points of the calipers and to determine the diameter of the groove.

A Two-Handed Safety Device

CHARLES H. WILLEY
Superintendent of Manufacturing,
Hoyt Electrical Instrument Works

Anything affecting the safety of the hands or fingers of operators of power presses should be given every consideration, and the best protective devices should be installed. We have many power presses in use and have equipped them with the safety device illustrated herewith.

The clutch on each press is engaged by depressing the rod *A*, which originally connected the clutch trip directly to the pedal. We cut this rod and connected the ends to the lever *B*, which is pivoted at *C*. It will readily be seen that when the release rod is depressed, the lever *B* must swing downward, and that it is normally prevented from doing so by the rods *D* and *E* beneath its free end.



In order to operate the clutch, the rods must first be brought from under the pivoted lever by depressing the handles *H* and *J*, requiring the operator to use both of his hands, thus keeping them out of danger.

When the clutch is disengaged, the pivoted lever is in the position shown. Helical springs connected to the lever and to the stud *K* bring the ends of the rods under the lever as soon as the handles are let go, thus blocking the lever and preventing its downward movement. From the foregoing it will be seen that it is impossible to operate the press without depressing both of the handles.

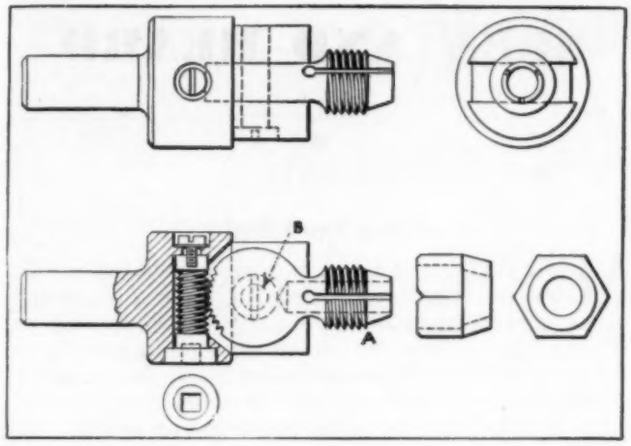
A cross rib on the under side of the lever acts as a stop for the ends of the rods and prevents them from being drawn too far inward by the springs. The ends of the rods are hardened to prevent wear. A study of this device will show that it is rugged and positive.

■

Boring-Tool Holder for the Milling Machine

A. J. WORMWOOD
Supervisor of Gages,
Independent Pneumatic Tool Company

The device shown in the illustration is for holding and adjusting round-shanked boring tools in the milling machine. The shank of the boring tool is held in the spring chuck *A*, which is shown without its threaded cap. The shank of the chuck is flat in one plane and is rounded in the other. It fits in a slot in the body of the holder and swivels on the pin *B*. Teeth are cut in the back of the rounded part, forming a segment of a worm-



wheel. Passing transversely through the body of the holder is a worm that meshes with the teeth referred to above, suitable provision being made to prevent end motion. The worm is mortised at one end to receive a solid, square-ended wrench.

It will be seen that turning the worm will rotate the chuck shank about its pivot pin, moving the chuck nose away from or toward the center line, depending upon which way the worm is turned. Thus the holder serves as a so-called expansion boring head. When placed over the holder just back of the chuck jaws, a knurled sleeve covers the slot and prevents chips or dirt from getting into the mechanism.

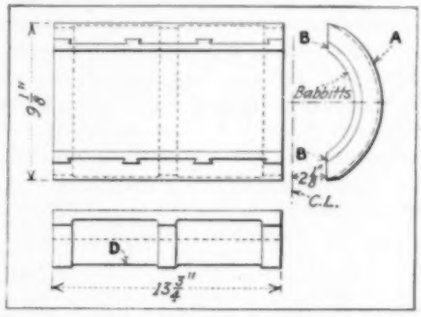
I do not know who is responsible for the design of this holder, but it was brought into our plant by a toolmaker about ten years ago.

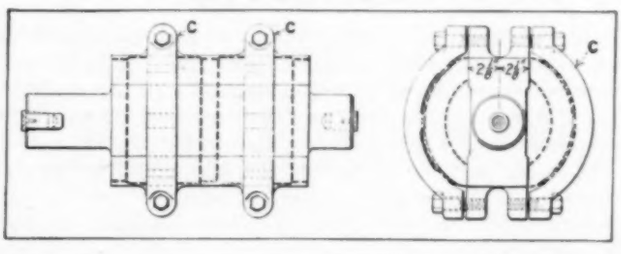
■

Mandrel for Turning Bearing Shells

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Krocschell Company

In turning the outer diameter of the cast-iron shells for the main bearings for our compressors, one of which is shown in Fig. 1, it is necessary to clamp them on the special mandrel shown in Fig. 2. The turned surfaces *A*, Fig. 1, are $1\frac{1}{8}$ in. wide. After the shells have been babbitted, the surfaces *B* are machined to $2\frac{1}{8}$ in. from the center line.





The body of the mandrel, Fig. 2, is cast iron and the ends are turned to $2\frac{3}{4}$ in. in diameter and flats are milled for the clamping screw of the lathe dog. Hardened taper plugs, center drilled, countersunk, and cupped are driven into taper holes in the ends. The flat surfaces on the body of the mandrel are machined to the dimensions given, which correspond to the $2\frac{1}{8}$-in. dimension on the shells.

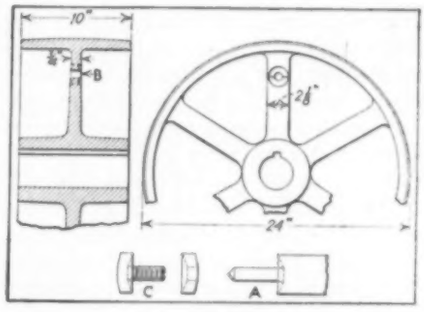
While but one shell is used on a compressor, the shells are machined in pairs to facilitate calipering. Two shells are held on the mandrel by the cast-iron clamps *C*, which are drawn together by capscrews. Each half of a clamp has a 3-point bearing on the unfinished surfaces between the turned parts. The overall dimensions of the mandrel body are 0.020 in. less than the finished length of the shells, so that when facing the ends of the shells a 0.010-in. feeler can be used to set the facing tool. One of the features of the mandrel is that it can be loaded and unloaded without removing it from the lathe centers.

■

Repairing Cracked Pulley Spokes

RICHARD H. KIDDLE
Kiddle's Machine Tool Works

We had a 10x24-in. pulley in which one of the spokes was cracked about half way between the hub and the rim. Since the pulley was not a split one, it could not be removed from the shaft without uncoupling the shaft and removing several other pulleys, so we decided to make repairs without going to the expense of removing it. A hole was drilled through the spoke at the crack, as shown in the illustration. With a fish-tail counterbore, such as shown at *A*, we cut into both sides of the cracked spoke, as at *B*. A bolt and a nut, as at *C*, were made to fit the counterbored grooves, and a copper washer was put under the nut to act as a cushion. Tightening the nut tended to draw together the parts of the spoke on each side of the crack. If we had fished the cracked spoke with plates, the extra weight would have made the pulley badly out of balance.



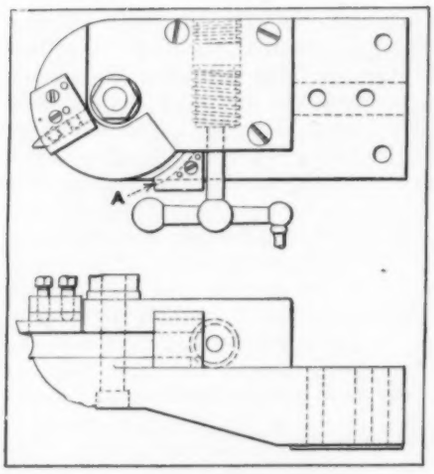
Several months after making the repairs, another one of the spokes cracked. We repaired it in the same manner as we did the original break, and the pulley is still on the job.

■

Boring Spherical Seats—*Discussion*

L. O. BROWN

The tool for boring spherical seats described by George Odum, on page 752, Vol. 73, of the *American Machinist*, is similar to one that I ran across about fifteen years ago. While the tool described by Mr. Odum was for use in



a drill press, the one shown in the accompanying illustration was used in a flat-turret lathe, being mounted on the turret. The work done by the tool was the finishing of the inner spherical surface of a differential case for automobiles, the material being drop-forged steel.

The toolbit is held in a holder attached to the worm-wheel, and is adjustable for height by means of the usual rocker. The feed is through a worm, on the shaft of which is a ball crank. The hardened block *A* is used for setting the toolbit to the correct radius. By the use of this tool, a good, smooth finish was obtained.

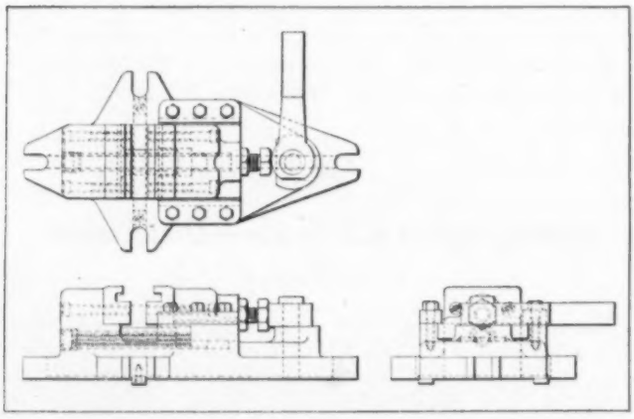
■

A General Utility Machine Vise

CLIFFORD CORNWALL
Toronto, Ontario, Canada

The rapid-action machine vise shown in the illustration has provision for changing the jaws to suit various production work. Alignment grooves and lugs on the under side of the base, and bolt lugs at right angles to one another, permit the vise to be set in a position best suited to the work in hand.

The movable jaw is closed by a lever having a cam at its end, the cam having two opposite locking points, making it possible to have the lever in a convenient position for whichever way the vise may be placed. While the lever is short, it may be extended by putting a piece of pipe over the end. The movable jaw is opened by a coil spring that can be adjusted for compression by a screw plug. The screw in the movable jaw, contacting with the cam, can be adjusted and locked in any position to allow for the various-sized pieces to be held, and to permit the cam lever to be in the most convenient position when the jaw is locked.



SEEN AND HEARD

●

Using Tools Right

MAGNETIC CHUCKS, in common with many other devices, have been cussed for faults that existed in the application rather than in the chucks themselves. A recent case came out of an attempt to grind long square stock from the rough by holding it on a magnetic chuck. When it came off the chuck it was "out a mile"—more or less. Then a real mechanic got on the job. He clamped the bars from the side, letting them lie easily before clamping. After he got one flat surface he used the magnetic chuck with good results. Internal stresses must be relieved if the finished work is to be straight and true.

Cutting Coarse Threads

CUTTING coarse threads is always something of a problem, the amount of metal to be removed frequently determining the method to be used. The new threading machines and new dieheads are making it possible to cut much coarser threads than ever before, but the demand for lower production costs are never quite satisfied.

A correspondent wishes to cut some Acme form threads 1 in. diam. 2½ double, about 7 in. long, and some 2 in. diam. 2½ single threads about 30 in. long. How can these be cut best for a production of 30 to 50 per month, and also if the demand increase to 300 per month? Should they be chased, milled, or cut with a die? —*J. R. G.*

Growing Gages

MAKERS OF gages have long been annoyed by the tendency of hardened steel to grow. This characteristic is particularly objectionable for precision blocks when accuracy is measured in millionths. In the past, rechecking and relapping was required to insure continued precision. The growth was attributed to molecular readjustment occurring during expansion and contraction with changes in temperature. To accelerate this process and to relieve growing pains in the steel before the final lapping, recourse was made to seasoning processes. One common practice was to quench the blocks alternately in ice water and boiling water or heated oil. Now at least one manufacturer has gone a step further by substituting liquid air for the ice water. That should hold the molecules for a while.

Ground Thread Taps

WE ALL seek the one best way to do things, but even in practices which have gone on for years, disagreement may be found. As an example, ground taps are made in two different ways. One way is to machine the tap with an allowance for grinding and then to harden and grind. The other way is to harden the blank and grind the threads from the solid. Each procedure has its exponents. —*J.*

Standard Woodruff Keys and Keyslots

STANDARDIZATION of Woodruff keys was undertaken by the American Standards Association with a view to establishing a logical and simplified series to replace, with least possible disturbance, the several individual standards now in use.

Maximum and minimum limits indicated for key width are such that assembly with the keyslot can be made without distortion of the shaft or the necessity of selective fitting when the maximum key is inserted in the minimum keyslot, and also without shake when the minimum key is inserted in the maximum keyslot. For more particular work, however, the specified fit may be obtained by gaging the finished keyslot and selecting by measurement the key required. Breaking the corners of the key with a 0.010-in. radius is optional, but sharp edges shall be removed from all finished keys.

In addition to the dimensions of the key, Table 1 gives the distance, *E*, from the center of the circle forming the key profile to the top of the key with a 0.010-in. radius is optional, but sharp edges shall be removed the slot, not from the shaft circumference on the centerline of the key,

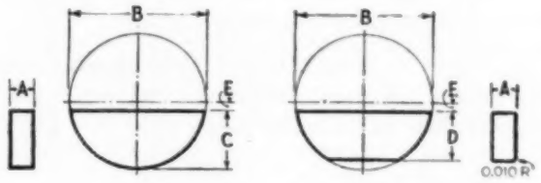


Table No. 1 Woodruff Key Dimensions

Key[1] Number	Nominal Key Size A × B	Width of Key A		Diam. of Key B		Height of Key C		Height of Key D		Distance Below Center E
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
204	1/16 × 1/2	0.0635	0.0625	0.500	0.490	.203	.198	.194	.188	3/64
304	3/32 × 1/2	0.0948	0.0938	0.500	0.490	.203	.198	.194	.188	3/64
305	3/32 × 5/8	0.0948	0.0938	0.625	0.615	.250	.245	.240	.234	1/16
404	1/8 × 1/2	0.1260	0.1250	0.500	0.490	.203	.198	.194	.188	3/64
405	1/8 × 5/8	0.1260	0.1250	0.625	0.615	.250	.245	.240	.234	1/16
406	1/8 × 3/4	0.1260	0.1250	0.750	0.740	.313	.308	.303	.297	1/16
505	5/32 × 5/8	0.1573	0.1563	0.625	0.615	.250	.245	.240	.234	1/16
506	5/32 × 3/4	0.1573	0.1563	0.750	0.740	.313	.308	.303	.297	1/16
507	5/32 × 7/8	0.1573	0.1563	0.875	0.865	.375	.370	.365	.359	1/16
606	3/16 × 3/4	0.1885	0.1875	0.750	0.740	.313	.308	.303	.297	1/16
607	3/16 × 7/8	0.1885	0.1875	0.875	0.865	.375	.370	.365	.359	1/16
608	3/16 × 1	0.1885	0.1875	1.000	0.990	.438	.433	.428	.422	1/16
609	3/16 × 1 1/8	0.1885	0.1875	1.125	1.115	.484	.479	.475	.469	5/64
807	1/4 × 7/8	0.2510	0.2500	0.875	0.865	.375	.370	.365	.359	1/16
808	1/4 × 1	0.2510	0.2500	1.000	0.990	.438	.433	.428	.422	1/16
809	1/4 × 1 1/8	0.2510	0.2500	1.125	1.115	.484	.479	.475	.469	5/64
810	1/4 × 1 1/4	0.2510	0.2500	1.250	1.240	.547	.542	.537	.531	5/64
811	1/4 × 1 3/8	0.2510	0.2500	1.375	1.365	.594	.589	.584	.578	3/32
812	1/4 × 1 1/2	0.2510	0.2500	1.500	1.490	.641	.636	.631	.625	7/64
1008	5/16 × 1	0.3135	0.3125	1.000	0.990	.438	.433	.428	.422	1/16
1009	5/16 × 1 1/8	0.3135	0.3125	1.125	1.115	.484	.479	.475	.469	5/64
1010	5/16 × 1 1/4	0.3135	0.3125	1.250	1.240	.547	.542	.537	.531	5/64
1011	5/16 × 1 3/8	0.3135	0.3125	1.375	1.365	.594	.589	.584	.578	3/32
1012	5/16 × 1 1/2	0.3135	0.3125	1.500	1.490	.641	.636	.631	.625	7/64
1210	3/8 × 1 1/4	0.3760	0.3750	1.250	1.240	.547	.542	.537	.531	5/64
1211	3/8 × 1 3/8	0.3760	0.3750	1.375	1.365	.594	.589	.584	.578	3/32
1212	3/8 × 1 1/2	0.3760	0.3750	1.500	1.490	.641	.636	.631	.625	7/64

All dimensions given in inches.

[1]Note: Key numbers indicate the nominal key dimensions. The last two digits give the nominal diameter (B) in eighths of an inch and the digits preceding the last two give the nominal width (A) in thirty-seconds of an inch. Thus, 204 indicates a key 2/32 × 4/8 or 1/16 × 1/2 inches; 1210 indicates a key 12/32 × 10/8 or 3/8 × 1 1/4 inches.

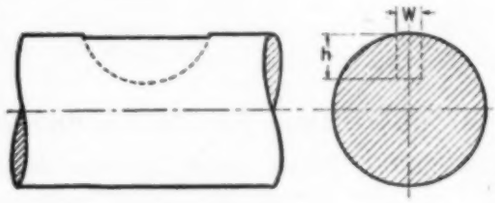


Table No. 2 Dimensions for Keyslot

Key[1] Number	Nominal Key Size A × B	Keyslot Width W		Keyslot Depth h	
		Max.	Min.	Max.	Min.
204	1/16 × 1/2	0.0630	0.0615	0.1718	0.1668
304	3/32 × 1/2	0.0943	0.0928	0.1561	0.1511
305	3/32 × 5/8	0.0943	0.0928	0.2031	0.1981
404	1/8 × 1/2	0.1255	0.1240	0.1405	0.1355
405	1/8 × 5/8	0.1255	0.1240	0.1875	0.1825
406	1/8 × 3/4	0.1255	0.1240	0.2505	0.2455
505	5/32 × 5/8	0.1568	0.1553	0.1719	0.1669
506	5/32 × 3/4	0.1568	0.1553	0.2349	0.2299
507	5/32 × 7/8	0.1568	0.1553	0.2969	0.2919
606	3/16 × 3/4	0.1880	0.1863	0.2193	0.2143
607	3/16 × 7/8	0.1880	0.1863	0.2813	0.2763
608	3/16 × 1	0.1880	0.1863	0.3443	0.3393
609	3/16 × 1 1/8	0.1880	0.1863	0.3903	0.3853
807	1/4 × 7/8	0.2505	0.2487	0.2500	0.2450
808	1/4 × 1	0.2505	0.2487	0.3130	0.3080
809	1/4 × 1 1/8	0.2505	0.2487	0.3590	0.3540
810	1/4 × 1 1/4	0.2505	0.2487	0.4220	0.4170
811	1/4 × 1 3/8	0.2505	0.2487	0.4690	0.4640
812	1/4 × 1 1/2	0.2505	0.2487	0.5160	0.5110
1008	5/16 × 1	0.3130	0.3111	0.2818	0.2768
1009	5/16 × 1 1/8	0.3130	0.3111	0.3278	0.3228
1010	5/16 × 1 1/4	0.3130	0.3111	0.3908	0.3858
1011	5/16 × 1 3/8	0.3130	0.3111	0.4378	0.4328
1012	5/16 × 1 1/2	0.3130	0.3111	0.4848	0.4798
1210	3/8 × 1 1/4	0.3755	0.3735	0.3595	0.3545
1211	3/8 × 1 3/8	0.3755	0.3735	0.4065	0.4015
1212	3/8 × 1 1/2	0.3755	0.3735	0.4535	0.4485

All dimensions given in inches.

[1]Note: Key numbers indicate the nominal key dimensions. The last two digits give the nominal diameter (B) in eighths of an inch and the digits preceding the last two give the nominal width (A) in thirty-seconds of an inch. Thus, 204 indicates a key 2/32 × 4/8 or 1/16 × 1/2 inches; 1210 indicates a key 12/32 × 10/8 or 3/8 × 1 1/4 inches.

therefore does not indicate the depth to which the cutter should be fed into the shaft. This amount varies with the shaft diameter. The amount by which the key, when in place, will extend from the shaft may be determined by subtracting the keyslot depth, *h* (Table 2), from the height of key, *C* (Table 1).

Two series of keyslot cutters, fine and coarse teeth, both of the shank type and having a shank diameter of 1/2 in. for all sizes, have been adopted also. The standard may be had from the Association at 29 West 39th Street, New York City.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, February 19, 1931

VOL. 74 NO. 8

A Square Deal for the Production Man

PRODUCTION men, as was very clearly brought out at the recent meeting of the S.A.E., are beginning to realize that they have been and are being made the goats in many industries. Not only are they handicapped by obsolete equipment but the accounting methods charge them with overhead on machines that should have been scrapped long ago and on unused equipment that is idle through no fault of theirs.

Management shifts responsibility for its inability to judge the probable demand to the production department which must be prepared to produce the maximum requirement and yet is expected to turn out a small output at the same relative cost. Management orders drastic changes in personnel that affect costs seriously and frequently gives production no chance to show how this handicaps both cost and quality, not only at present but in the days to come.

Production men may have to study accounting in self defense to prevent being charged with costs that belong to other departments. And management will do well to try and appreciate how much production men have done to bring about low costs.

Training Directors for Their Job

ONE of the weaknesses of the management of big business is the lack of contact between the directors and the production department, and their lack of knowledge of the details of the business itself. Some directors see only debits and credits, and do not discriminate between expense and investment. Production and personnel problems are neither understood nor appreciated.

According to reports, J. Lyons & Company of London, probably the largest concern in the world in their line of catering, have a regular training course for every man who is likely to become a director of the company. From two to three years are spent in working in the various branches of the kitchens, beginning in the fish shop of a restaurant kitchen and working up through soups and roasts to pastries and other deserts. The prospective director learns to buy supplies, studies the operation of restaurants, and is taught the importance of personal contacts and personnel relations.

While it may seem a far cry from catering to manufacturing metal products, the same principles hold good in both cases. Anyone can recall instances where businesses would have been run much more smoothly and economically if the directors had known more about the practical side of the business they were supposed to control.

A Low-Down Racket

THERE may be meaner rackets than that involved in requiring a "gratuity" to hire and to keep a man working on a job, but it is doubtful whether there are many that are more insidious or more likely to result ultimately in serious labor difficulties.

This refers, of course, not to legitimate employment agencies, many of which perform valuable services for both employer and employee, but to those leech-like individuals who, being in a position to control the hiring and firing of certain workers, use this power to extort from those so employed a part of their wages. The practice is especially pernicious when supplemented by a black-listing system which prevents a man who, perhaps through no real fault of his own, loses his job in one shop and is thereby barred from getting employment in other plants in the same town.

A case recently reported is that of a very competent machinist who, being in need because he could find no regular job for many months, finally secured work a half day a week in each of two shops, but in both instances was required to "tip" the foreman regularly to be allowed to earn even the small wage he got for this work!

Doubtless such rackets are worked in most instances without the knowledge of executives, who would put a stop to them instantly if they knew the true facts. Such facts should not be difficult to get, however. Those who know definitely of their existence in their plants might well see that this editorial is brought to the notice of the "big boss."

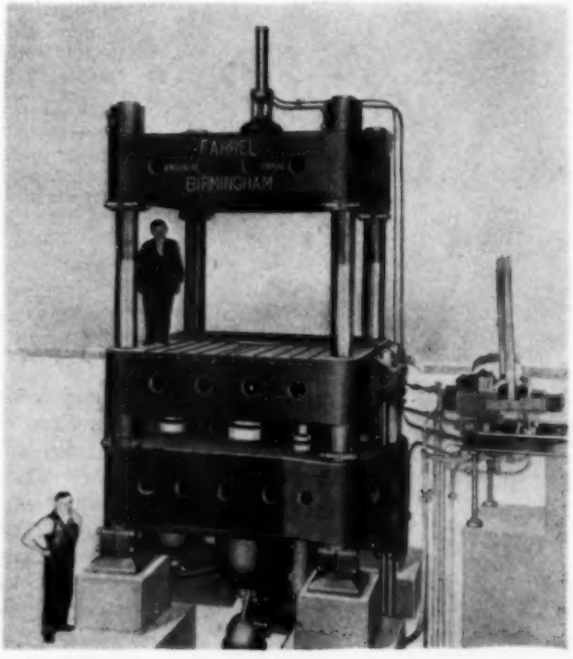
SHOP EQUIPMENT NEWS

Farrel-Birmingham 1,500-Ton Hydraulic Press

For the tank department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., the Farrel-Birmingham Company, Ansonia, Conn., has furnished a 1,500-ton hydraulic press for hot forming of tank ends, the ends of circuit breakers, oil switches, and other products. This press is designed for flanging and forming heavy metal parts. Besides the main 34-in. ram, which provides a pressure of 1,000 tons, the press is also equipped with two 18-in. auxiliary rams, which provide an additional 250 tons pressure each. The press, therefore, can be used as a triple-capacity machine; that is, for 500 tons, 1,000 tons, or 1,500 tons pressure, as required. The 500-ton capacity can be used for clamping and the 1,000 tons for drawing. In the latter case, the 34-in. ram works through the guides on the moving platen.

The press is 97x85 in. clear between the tierods, and has a maximum opening of 72 in. and a stroke of 48 in. The over-all height from the floor to the top is 13 ft. 8½ in., and the distance below the floor is 20 ft. 11½ in., making a total over-all height of 34 ft. 8 in. The floor space required is 13 ft. 3 in. x 9 ft. 6 in.

The press is equipped with auxiliary lifting rams for prefilling the main cylinders with water from the surge tank. The lifting cylinders operate the moving platen and the main 34-in. ram together or separately. For prefilling two hydraulic operating valves are used. All return strokes are accomplished hydraulically to assure necessary speed of operation. The press is equipped with one 250-ton knockout cylinder located in the top platen. Control and operating valves are of standard construction, and the spindles and seats are of Nitralloy steel to insure long life. Safety devices are provided to prevent damage to the press from incorrect operation.



Pressures of 500, 1,000, or 1,500 tons are available by proper use of auxiliary and main rams

"Universal Giant" Tool Grinder

For tungsten-carbide and high-speed steel tools the T. B. Wood's Sons Company, Chambersburg, Pa., is announcing the "Universal Giant" tool grinder. The two tilting tables may be set accurately at the required angle from horizontal. A quadrant and indicator insure the correctness of the angle. In addition, the machine is provided with a tool guide mounted on a straight edge that travels in slotted ways parallel with the edge of the grinding wheel. The tool guide may be set at any angle to the cutting edge of the grinding wheel by adjusting the protractor, which is an integral part.

The wheels are 12x4 in., running at 5,600 surface ft. per min. Drive is by means of a reversing, ball-bearing motor, so that either right- or

left-hand tools can be sharpened with the insert or tip always on top and in plain view of the operator. The machine is supplied complete with two grinding wheels, one 60 grain and one 120 grain, for roughing and finish sharpening, respectively. A belt-driven grinder can be supplied with a pulley and reversing countershaft.

Durez 476—A Sand Core Binder

Chemical reaction forms the bond when Durez 476 sand core binder is employed, and water only is driven off. This material, which is a development of General Plastics, Inc., North Tonawanda, N. Y., is a phe-

nolic condensation product and used in the same proportions as any core oil. Mechanical mixing of 7 to 10 minutes provides sufficient dispersion. Cores using this bond save one-third to one-half the usual baking time at oven temperatures from 425 to 500 deg. F. They bake brown and just as readily on the dryer side as on the exposed surface. The baked core retains excellent definition. It does not absorb moisture readily, and it will take all of the usual core washes, and may be green topped or booked, as required.

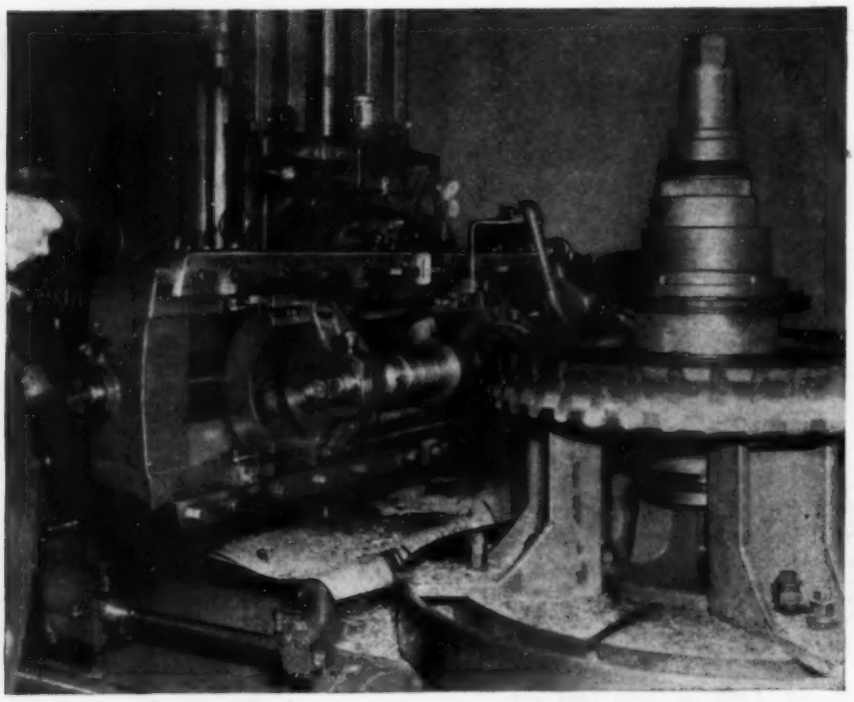
Tools can be cleaned with water rather than with an inflammable solvent when Durez 476 is used. The odor is that of carbolic acid. Knockout is readily accomplished. The ordinary mix leaves the casting clean and the sand may be used over again in any proportion. However, oil-mixed core sand should not be used with 476. It is especially adapted to intricate, difficult venting jobs in both gray iron and non-ferrous castings.

Reinecker Worm Gear Hobber with Tangential Feed

Coarse-pitch worm gears, particularly those of the multiple-thread type with long lead, can be hobbed on the Reinecker No. 6-N machine, which has been placed on the market in the United States by the George Scherr Company, 142 Liberty St., New York, N. Y. Worm gears may be cut by means of two different methods on this machine, either by feeding the hob radially into the gear blank until the correct depth has been reached, or by employing the tangential feed motion. In the latter case, a short hob, preferably a tapered one, is fed axially past the work. When small lots of gears are to be produced with this method or when time is a factor, it is not necessary to use hobs, since a single-tooth fly cutter will produce accurate results.

With the tangential feed, a theoretically correct and accurate worm gear with smooth tooth flanks is produced. It is particularly suitable where high leads, great angles, and wide faces are concerned. It must be employed to cut gears having a helix angle over 8 deg., as the in-feed method destroys the tooth flank. At the start of the operation a hob or fly cutter is at one end of the wheel blank. Both the hob and the gear rotate and the hob or fly cutter is fed into the blank in the direction of its axis. The axial feed toward the wheel necessitates a second motion for the blank obtained by a differential change gear mechanism that connects the index gears with the feed. The feed is obtained by a quick change feed gearbox on the side of the machine. By means of three lever positions and two pick-off gears, 24 different feed changes from 0.006 to 0.327 in. can be obtained. The index change gears are located at the rear of the machine.

Drive is by means of a 15-hp., constant-speed motor with a gearbox arranged at the bottom of the housing. Thus, 18 different cutter speeds from 15 to 101 r.p.m. may be obtained. The gears in the gearbox are hardened and ground to afford smooth running. A separate 5-hp. motor is provided for the rapid adjustment of the upright in or out, rapid return of the cutter head up or down, and for the rapid return of the tangential feed slide. The cutter head may be swiveled so that spur gears, as well as spiral gears up to 25 deg. angle, may be cut, and also worm gears with the worm axis inclined 25 deg. to the wheel plane.



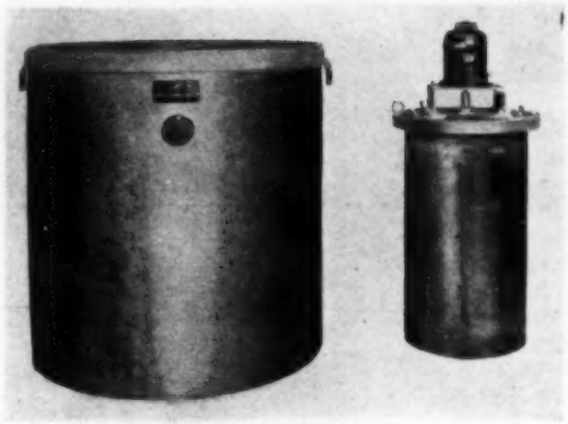
Close-up of Reinecker No. 6-N Worm Gear Hobber with Tangential Feed, showing the cutter slide which may be swiveled up to 25 deg.

Specifications of the No. 6-N Machine

Maximum diameter of spur, worm, and spiral gears, in.	90½
Maximum face, in.	23½
Pitch capacity, D.P.	2¾
Maximum diameter of hob, in.	13¾
Minimum and maximum center distances, in.	3⅛-50
Diameter of table, in.	52¾
Diameter of bore in table, in.	7⅛
Diameter of dividing wheel, in.	48
Diameter of work arbor, in.	3
Diameter of hob arbors, in.	1¼-1½-2
Power required, hp.	15 & 5
Net weight, lb.	31,000

Noyes Semi-Finished Toolbits

Semi-finished toolbits in three shapes are being carried in stock by The Noyes Tool Sales Company, Bridgeport, Conn. These shapes are standard toolbits, shaper corner tools, and round nose, thread or side tools. They are carried in stock of standard brands of high speed steel, and the shapes furnished are such that they are readily adaptable for finishing to the requirements of general work, and a minimum amount of grinding need be done.



General Electric Vertical Nitriding Furnace, available in two sizes with retort dimensions of 14⅜ x 18 in., and 20½ x 26 in.

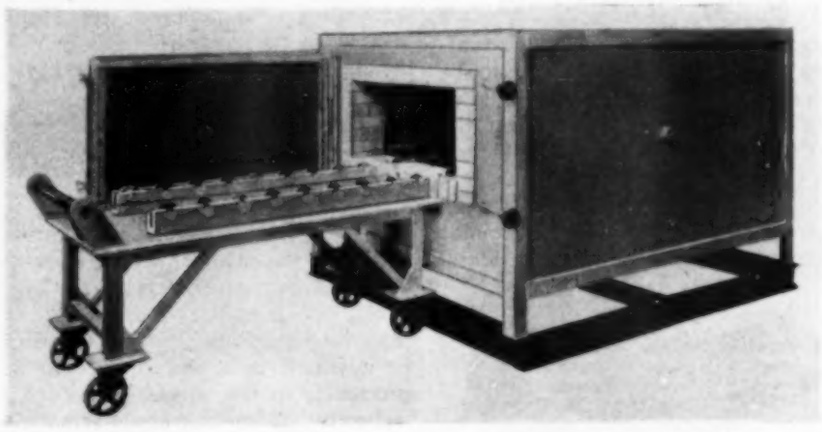
General Electric Batch-Type Nitriding Furnaces

A complete line of batch-type nitriding furnaces for use at temperatures up to 1,200 deg. F. has been developed by the General Electric Company, Schenectady, N. Y. Included in the line are two sizes of vertical, cylindrical furnaces with a fan for circulating the ammonia gas, and two sizes of box-type furnaces complete with charging trucks for handling the retorts.

The vertical furnace consists of an outer shell containing the heating units of nickel-chromium resistor ribbon and an inner retort, which is inserted into the furnace through a hole in the cover. The retort is made in two parts, the upper part containing the motor and fan, and the lower part containing the charge to be nitrided. The upper half of the retort is part of the cover and is heavily insulated to keep the motor at operating temperature and to keep the radiation losses at a minimum. The lower part of the retort is a special alloy-steel container welded gas tight. A basket is provided for the charge. A close-fitting alloy steel hood covers the fan and fits down on the basket, thus guiding the circulation of gas through the charge.

The two halves of the retort are bolted securely. Gas leakage is prevented by means of an asbestos ring gasket. The inlet and outlet for the ammonia are through the cover, so that the complete retort can be withdrawn from the furnace at the end of the nitriding cycle and allowed to cool outside. The furnace can be recharged immediately by utilizing a spare retort. This furnace is available in two sizes, the smaller having loading dimensions of 14⅜ in. in diameter by 18 in. deep, and rated at 23 kw., 220 volts, 3 phase. The larger furnace has loading dimensions of 20½ in. in diameter by 26 in. deep, and is rated at 30 kw., 220 volts, 3 phase.

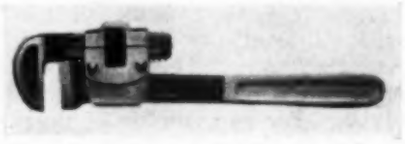
The box-type furnaces require little headroom and comparatively small floor space. Light-weight refractory brick is used in the furnace, and a simple swing-type door with screw clamps and an asbestos gasket are provided. A rack and roller track are attached to the floor of the furnace to assure ready insertion and removal of the alloy-steel retort. The cover of the retort is provided with a turned down lip which engages in a groove around the top of the retort itself. This furnace is available also in two sizes, the larger being rated at 40 kw., 220 volts, 3 phase and having retort dimensions of 28 in. wide by 48 in. long by 11 in. deep. The smaller size is rated at 30 kw., 220 volts, 3 phase, and has retort dimensions of 19½ in. wide by 48 in. long by 11 in. high. A sturdy charging truck, equipped with a rack and rollers, can be supplied for handling the steel retort. Because of the long holding cycles of the nitriding process, control panels are furnished with a switch by means of which the current input may be reduced to one-third of the rated value. The manufacturer is also preparing to furnish a unit package containing all valves and gages required, and with all dissociation apparatus and glassware mounted in a glass paneled steel cabinet.



General Electric Box-Type Nitriding Furnace with charging truck in place

Threadwell All-Steel Stillson Pipe Wrench

Heavy-gage steel is employed for the frame of the Stillson pipe wrench announced by The Threadwell Tool Company, Mechanics Tool & Wrench

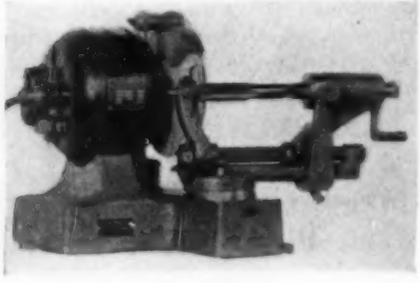


Company, Lessee, Greenfield, Mass. This frame is braced against spreading from side strain by two oversize steel rivets. A special double-action spring is employed, which can be re-

moved easily and replaced without the use of tools. The handle forging is not weakened by the drilling of holes for riveting on of springs. The pipe wrench is made in six sizes as follows: 6, 8, 10, 14, 18 and 24 in., having capacities from ½- to 2½-in. pipe.

"Wells" No. 13 Tap Grinder

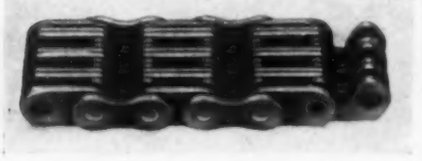
For grinding taps from ¼ to 1 in., hand taps, and pipe taps from ⅛ to 2 in., the Wells Manufacturing Company, P.O. Box 613, Greenfield, Mass., has developed a machine em-



ploying a special chuck on which machine-screw taps as small as No. 6 can be ground. The standard unit takes tools up to 7 in. long, but can be adjusted to take tools up to 12½ in. long. All lengths of reamers can be ground with a round cut on the point and an eccentric relief. Cams can be furnished for any number of flutes. The machine is equipped with a ¼-hp. motor and a diamond truing device.

Whitney Reversible Side-Guide Silent Chain

A reversible silent chain that allows the direction of driving to be reversed and will drive on either or both faces has been placed on the market by the Whitney Manufacturing Company, Hartford, Conn. It is particularly adaptable to installations where lack of vibration is desirable; where it is desired to drive several shafts in different directions of rotation; or where it is necessary to install a chain take-up device to operate on the back of the chain.



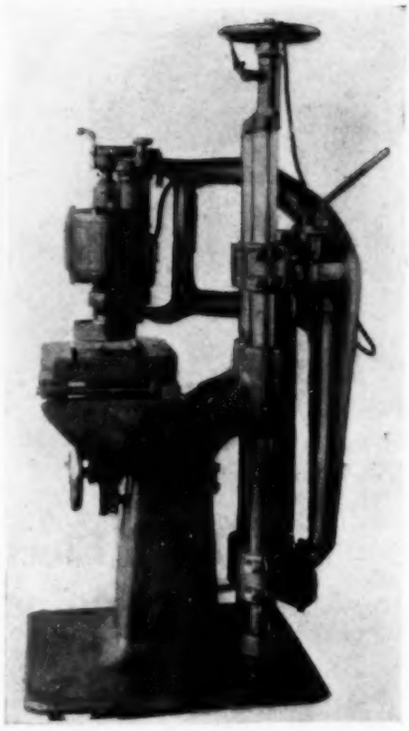
The chain utilizes a double internal chain-link and sprocket-tooth engagement on either face on one row of links across the chain, with the supporting external engagement of the next row of links on either side of the internal contacting row. This construction gives the joint load relieving features of the standard single-face, automotive, internal-engagement silent chain, supplemented by the rigidity and strength of the external method of chain-link and sprocket-tooth engagement. The side-guide type of chain construction is used and only chains of an even number of pitches can be employed.

In selecting sprockets for use with the reversible chain, it is necessary to choose those with diameters that employ an even number of teeth when designed for the conventional single-face chain, since every other tooth is removed in the reversible chain sprockets to permit the passage of the back of the reverse-face links in their travel over the sprockets.

"Ace" Surface Grinder

Instead of having the work travel past the wheel, the "Ace" surface grinder has the grinding wheel mounted in a swinging arm so that the operator may determine or "feel" the highest rate of feed at which the wheel is able to cut efficiently. This grinder is especially adapted for the maintenance of punches and dies, since the scales and indicators provided permit the table to be reset for duplicating the amount of shear ground on the cutting or punching members. It has been developed by R. P. Thompson, Pocomoke, Md., and is marketed by L. V. Goebbels, 4419 Larchwood Ave., Philadelphia, Pa.

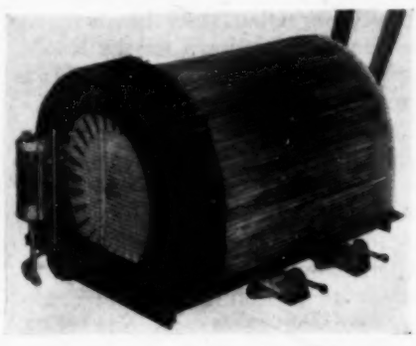
The work-table of the grinder is adjustable at an angle to the plane in which the wheel travels, both in the transverse and lateral directions. Work of irregular shape may be placed on the table, which can then be adjusted until the surface to be ground is in the proper plane. Attachments of various kinds are available for use in grinding cutters,



reamers knives, and other tools. The grinding table measures 12 by 18 in. The height of the travel of the wheel over the table is 11 in. A 5-in. wheel is employed, and is driven by a ¾-hp. motor.

Daun-Walter Motor Enclosure

For prevention of accumulation of dust and moisture on motors, the Daun-Walter Company, Milwaukee, Wis., has announced a corrugated copper cover having steel end walls and a supporting baseplate. At one end of the enclosure are provided a cooling fan and an outside combination guard and air deflector. The cooling fan is mounted on the end of the motor shaft away from the



pulley by means of a special shaft adaptor. By means of the fan and the air deflector, outside air discharges over the outside areas of the deep-fin corrugated copper construction over the motor, thereby carrying off the heat from the interior. The baseplate is of heavy steel in which the motor is placed and prevents the entrance of dirt and moisture from below. The complete enclosure is so designed as to permit mounting on motor slide rails for belt adjustment.

The enclosure is made for all open-frame motors, in sizes from 5 to 100 hp., and same size d.c. motors.

Wadkin Junior Pattern Milling Machine

A smaller model than the Wadkin universal pattern miller has been placed on the market in the United States by the Oliver Machinery Company, Grand Rapids, Mich. This machine known as the "Wadkin Junior," is of slightly modified design. It offers essential characteristics as follows: first, the machine is flexible to give a combination of movements that will readily and conveniently operate on geometric and irregular patterns; second, it offers an effective range of adjustments, quick action, fine feed motions, and stops for automatically controlling the limits of cutting, and third, the machine is adaptable to almost any class of work.

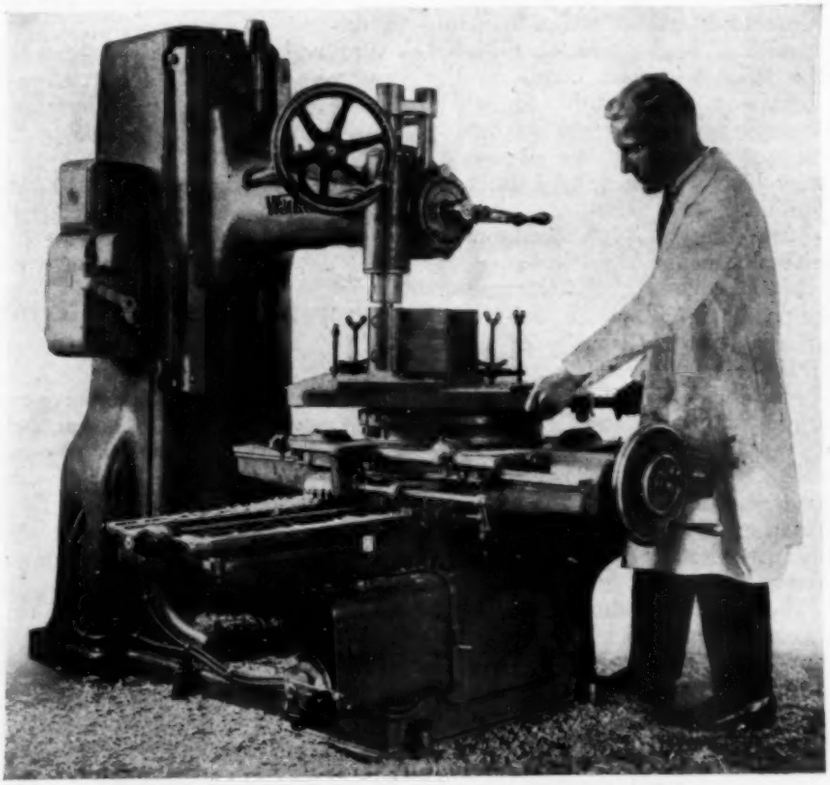
The overhanging arm is movable vertically and carries a spindle head. Distance between the center of the cutter spindle and the frame is 28 in. The spindle head swivels between the vertical and horizontal, the principle angles being indexed and located by a taper spring plunger. Intermediate angles are registered by a scale, and the head secured by a locking handle. When the spindle is in the horizontal position, the maximum distance between the cutter spindle and the work table is 18 in., which is reduced to 15 in. when the spindle is swiveled to the vertical position.

The spindle runs in ball bearings contained in dust-tight housings. Both the spindle and chuck are forged in one piece, and the chuck bored No. 5 Morse taper. The back end is threaded for a screw tang. A wide range of cutter holders and blocks carrying various types of cutters can be used.

Spindle feed is accomplished by a hand lever, and is arranged with a spring plunger to give definite depths of feed. It is also provided with limit stops. The drive is transmitted to the cutter spindle by a spindle running the full length of the arm. At the frame end it is pulley driven from the motor pulley or countershaft in the base. The belt is so arranged that the raising and lowering of the arm does not affect the belt tension. At the cutter spindle head the drive is transmitted by special spiral gears with ground teeth and totally enclosed. A feature of this drive is that it allows the spindle to drop below the level of the work to enter a corebox with its axis parallel to the surface of the work. It also allows the cutters to be carried close to the bearings, dispensing with long boring bars. Furthermore, it enables the spindle to occupy an angular position and thus saves resetting the work.

Two spindle speeds, 4,300 and 2,700 r.p.m., are provided. These speeds are obtained either by means of a variable-speed motor or by a two-speed gearbox.

Longitudinal table traverse is 44 in., and lateral traverse, 22 in. The table may also be rotated, a spring-plunger taper pin engaging with holes at principal angles. By means of a simple attachment secured to the table, the machine cuts gears of various types with mechanical accuracy. An ordinary spur gear may be cut at the rate of one complete tooth every minute.



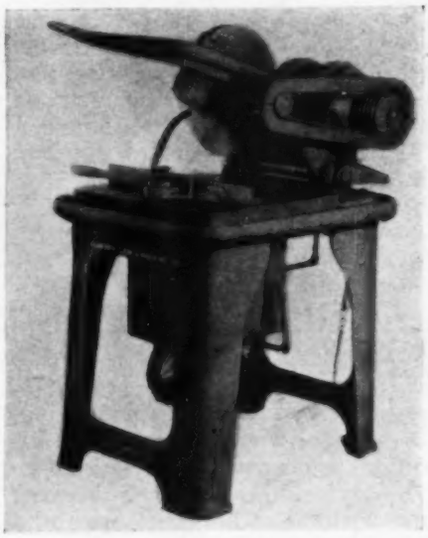
Wadkin Junior Pattern Milling Machine, which has a distance between the spindle and table of 18 in., and the spindle to the frame of 28 in.

Hunter No. 6 High-Speed Metal Cut-Off Saw

Light-section steel tubes and shapes can be cut off on the No. 6 high-speed metal cut-off saw being placed on the market by the Hunter Saw & Machine Company, Pittsburgh, Pa. It is made in two other types as follows: The 6A machine is designed for cutting brass and copper solids, shapes, and tubing. The design of this machine is the same as the No. 6, except

that it is equipped with a 3-hp. motor, and that a ⅛-hp. motor is used to drive a coolant pump. The No. 6B machine is designed for cutting aluminum bars, shapes, and tubing, and has a higher peripheral speed for the saw. The machine is equipped with a 5-hp. motor and an 18-in. toothed saw for cutting steel, and with a 3-hp. motor and 14-in. saw for brass, copper and aluminum. Saws of any diameter from 10 to 18 in. can be used.

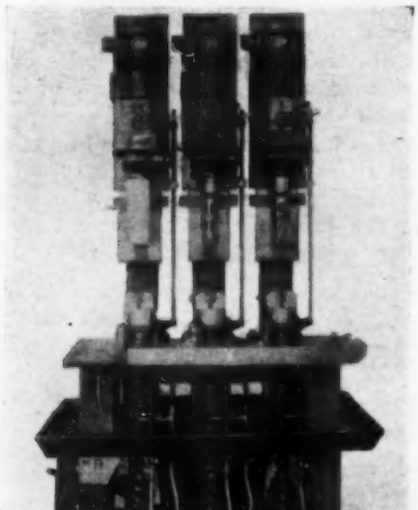
The motor and saw arbor are mounted on opposite ends of a balanced swing frame, and the saw blade is driven by V-belts. The arbor is mounted on Timken bearings. By means of an offside hand lever the saw blade is pulled through the material. The saw table has a cast ledge for catching the coolant and returning it to the reservoir, as well as four machined T-slots running the entire length. Vise jaws can be adjusted to make angular as well as straight cuts. A drawer-type chip pan is mounted underneath the saw table.



Hunter No. 6 Cut-Off Saw

Langelier Semi-Automatic Second-Operation Capscrew Machine

Squaring up under the head and rounding the end of capscrew blanks can be done on the semi-automatic machine announced by the Langelier Manufacturing Company, Providence, R. I. The blanks are of nickel steel, the head portion being produced by upsetting and leaving a fillet underneath. The end, which is threaded at a later operation, comes to the machine in the condition in which the stock is cut off. The machine is arranged to accommodate all sizes of screw blanks from ¼ by 1 in. to ⅝ by 6 in.



Production of 30 nickel-steel capscrews squared-up under the head and rounded on the end can be obtained per min. from this Langelier Semi-Automatic Machine

Three Langelier No. 21 automatic units are mounted vertically on individual columns. Each unit is equipped with a special tool having inserted cutters capable of being adjusted for any diameter and length of screw within the range. Coolness of the cutters and the washing out of chips are obtained by a lubricating system. Each unit is driven by individual motors and the tool is revolved at 700 r.p.m., and is arranged with a vertical feed of ¼-in. and rapid return.

The work is held in a two-jaw chuck having suitable inserts to grip the head of the screw and allow sufficient projection for the squaring operation. Each chuck is air-operated through the medium of a cylinder and draw rod, and is controlled by a conveniently located valve lever just above the table. This lever also furnishes control for another air cylinder for raising the chuck up into the working position. It is arranged with a nut and check nut on the piston rod to provide an adjustable stop for height.

In operation, the spindles revolve continuously, the operator inserting the head of the screw in the opened chuck jaws and moving the valve lever. The screw is gripped immediately and the chuck then elevates to the working position, coming against the adjustable stop and remaining in this position during the working cycle. During the raising operation, the shank portion of the screw passes up inside the tool and is in position to receive the cut. Just prior to reaching the point of extreme upward travel, a latch, which is adjustably mounted on a rod fixed in the chuck base and moves upward with it, next trips the single-cycle clutch, which is part of the head unit. The tool is fed against the work and returns rapidly to its original position after completing the cut. The operator then moves the valve to the exhaust position, the work is lowered rapidly, and at the end of the downward stroke the chuck jaws open, allowing the operator to remove the finished piece and insert another blank.

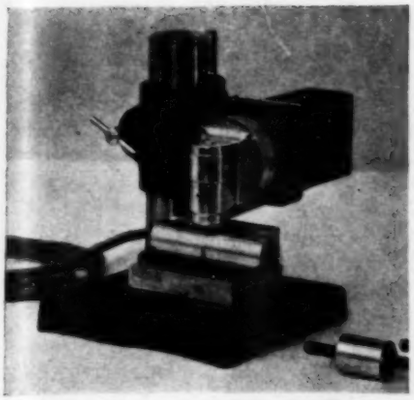
Production obtained averages ten capscrews per minute from each spindle or a possible 30 pieces per min. from the machine, utilizing the three spindles.

Floor space occupied is 48x60 in., height, 85 in., and weight, 3,200 lb.

General Electric Magnifying Electric Gage

An electric gage that measures one one-hundred thousandth of an inch, and then magnifies that infinitesimal dimension 10,000 times, has been developed by the General Electric Company, Schenectady, N. Y. The electric gage first measures the work and then instantaneously multiplies the measurement so that it can be read easily. This type of gage is suitable for almost any type of measurement with certain changes in the set-up. It may be used to measure outside dimensions of automobile wrist-pins, the inside dimensions of automobile cylinders, and the thickness of flat materials.

In one process, it is necessary to

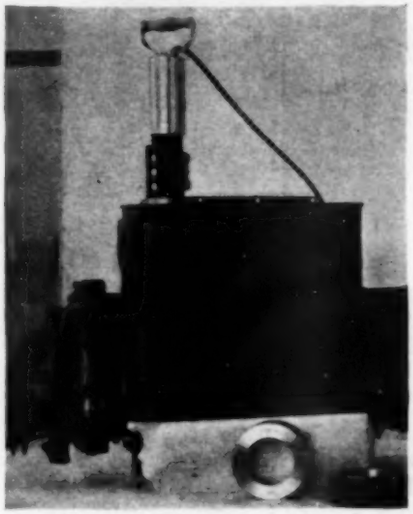


General Electric Magnifying Electric Gage head and stand for measuring outside diameters. Two masters are shown

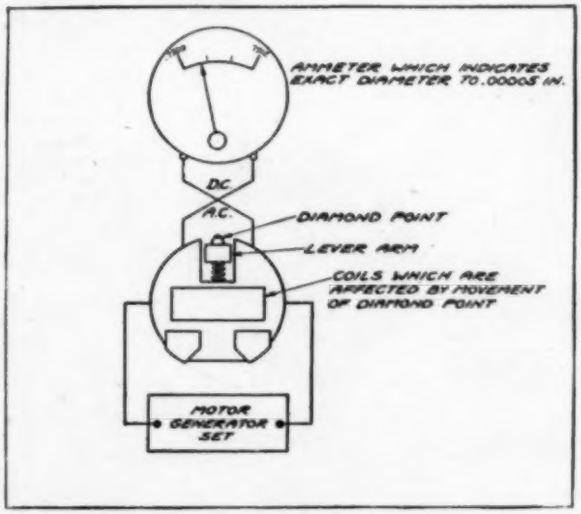
gage the crank-pin hole in pistons. The piston is placed over a spindle and rotated once, while the operator watches the pointer on a scale. Approximate limits beyond which the work is rejected are indicated. The "accept" limit in this case covers 3 in. on the scale and represents three ten-thousandths of an inch on the work. The gage can pass hundreds of thousands of pistons with no renewal or refinishing of parts, whereas the "paddle" type did only 400.

The gage consists essentially of a contact point supported to move through a limited distance in the direction of measurement, say 0.0005 in. This movement causes a pointer to travel 5 in. over the scale of an indicating instrument. The 10,000-times magnification movement is obtained by unbalancing a bridge circuit of four inductances. A 500-cycle alternator supplies power to a small transformer which, in turn, supplies power to the four inductances. Two of these are small coils in the electric gage head, which is about 5 x 2½ x 1½ in. in size. The inductance of these is varied by the movement of a pivoted steel lever armature, one end of which moves between the coils as the contact point on the other end conforms to the surface of the piece being measured. The contact point is in the gage spindle, which is made to fit the work. The other two inductances of the bridge, together with the transformer and indicating instrument, are mounted in an indicating unit, 12 x 12 x 12 in., which is placed in easy view of the operator.

The long life of the spindle of the electric gage is obtained by having the bearing surfaces made of tungsten carbide. The contact point which explores the piece is a diamond. Contact pressures are sufficiently low so that the material being gaged will not be scratched. The gage is calibrated in place by adjusting the distance between two small coils so as to bring the pointer on the scale.



General Electric Magnifying Electric Gage used by an automotive plant for checking cylinder bores



Schematic representation of the General Electric Magnifying Electric Gage

Possons Improved Safety Device for Presses

Refinements in the Possons positive safety device for power presses announced by the Positive Manufacturing Company, 4408 Perkins Ave., Cleveland, Ohio, make for increased ease of operation and adjustment. Features include: a visible cord and cable assembly bringing all working parts into plain view; adjustable ram-connection operating from below any possible breaking point, and a frame attachment adjustable to both the upright and inclined positions of the press. A special hand-strap is attached to the operator's wrist and passes under his thumb. The strap is attached by a quick-release safety clip to flexible cables. These pull-back cables extend upward through tubes supported on brackets attached to the main column, and are attached to a slide that operates up and down with the stroke of the press. A steel cable attaches the slide to a rocker arm connecting to the ram of the press.

Hand straps attached to cables running over pulleys to the press ram pull the operator's hands from the danger zone

In operation, the ram on its downward stroke pulls back the cables and removes the operator's hands from the danger zone. Adjustment of the pull-back may be made for any press operation. The amount of free cable,

the distance of pull-back, and the speed of withdrawal may be set to fit the job. There is no interference with work handling, and freedom of operation is allowed in every direction. Thus, either side or the floor can be reached with ease.

A pull-out multiplier has been designed for use on short-stroke presses or for jobs which require a quick withdrawal. It is geared so that from 3 to 5 in. of pull-out is allowed on the first ½ in. of the downward stroke of the press ram. A rack on the connecting rod engages with a cam and pinion mechanism. Acceleration of the pull-out results from the winding of the cable on the cam.

Vickers Hydraulic Pump

High volumetric efficiency, continuous working pressure at 500 lb. per sq.in., or to 1,000 lb. per sq.in. for press work, high mechanical efficiency, and long life with quiet operation are features of the V-type rotary pump being placed on the market by Vickers Incorporated, 7752 Dubois St., Detroit, Mich. The capacities of the two sizes available are 15 and 30 gal. per min. at 1,000 r.p.m. The pumps are for use in all machinery where hydraulic control or hydraulically controlled mechanisms are desired.

The pump shown in the illustrations requires small installation space in proportion to its capacity. All parts can be readily removed from one end without disturbing the set-up or the piping. The rotor and ring are of Nitralloy hardened and ground, and the port flange and bearing flange are of hydraulic bronze. The harmonic curve in the ring at the ports, which joins the concentric curve at the ends, gives a balanced pressure on both sides of the vane, thus eliminating unevenness in flow and increasing the mechanical efficiency. A cork gasket forms a seal between the flange and the removable end plate. The casing is of special high-test nickel cast iron. Parts are interchangeable, and larger capacity can be gained by changing the internal parts.

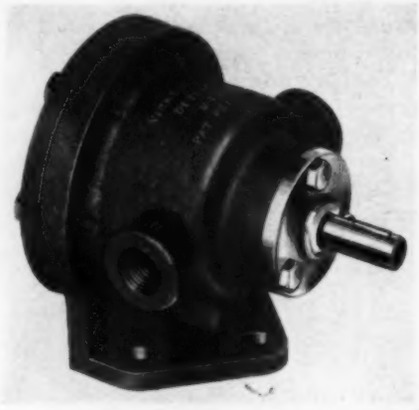


Fig. 1—Vickers Hydraulic pump, available in two sizes, 15 or 30 gal. per min. at 1,000 r.p.m. and 1,000 lb. per sq. in. for hydraulic control of machine mechanisms

Mechanical efficiency of the pump is from 82 to 86 per cent, and there is no appreciable drop in efficiency at high pressures. The volumetric efficiency at 500 lb. per sq.in. delivery pressure is approximately 98 per cent. Weight of the pump is 31½ lb.

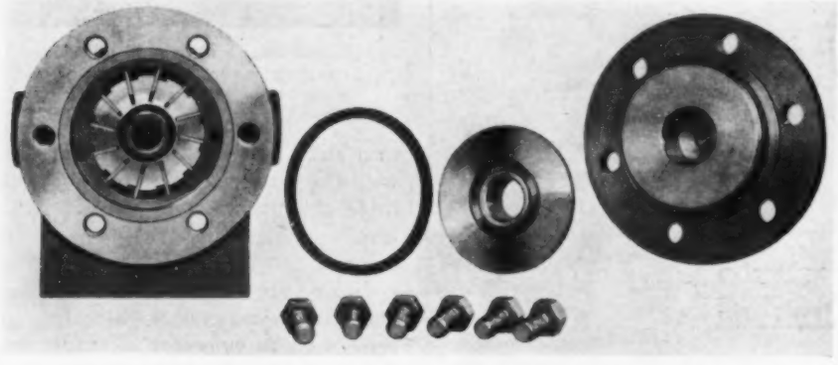
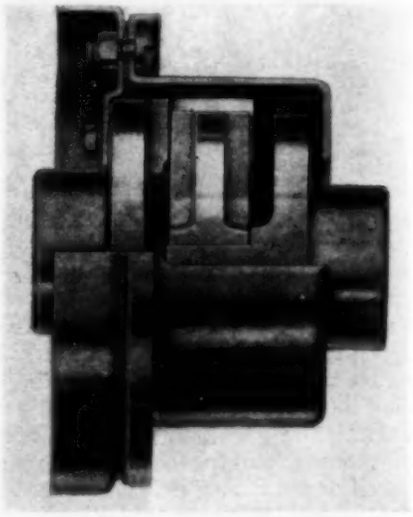


Fig. 2—Components of the Vickers Hydraulic Pump, showing in particular the cross-section of the pumping chamber and the numerous vanes employed to get smooth flow

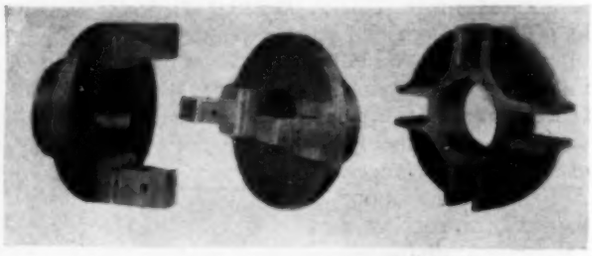
Francke Cross-Type Flexible Coupling

Shaft misalignment up to $\frac{1}{16}$ in. can be taken care of by the Francke cross-type flexible coupling for small drives announced by Smith & Serrell, Globe Indemnity Bldg., Newark, N. J. This type of coupling is suitable for drives where spring cushion for load shocks is not important. It handles center misalignment because it maintains large, evenly loaded, and well lubricated bearing areas unchanged under all operating conditions. It also provides small resistance to endwise float and handles a limited amount of angularity. The three main parts are the two forged steel flanges and the cross. A pressed-steel grease cover is added.

The coupling is manufactured in four sizes having maximum bores from 1⅛ to 1⅞ in., and with ratings of 2 to 10 hp. at 1,150 r.p.m., or 3 to 15 hp. at 1,800 r.p.m.



Franke Cross-Type Flexible Coupling shown with the shafts misaligned

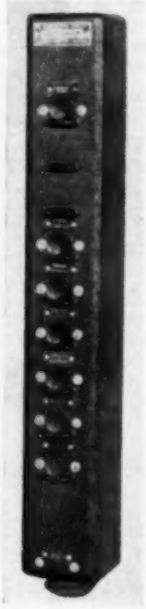


Two forged steel flanges and a cast-iron cross of the Franke Cross-Type Flexible Coupling

General Electric Push-Button Crane Control

A pendant-type push button for controlling small floor-operated cranes has been announced by the General Electric Company, Schenectady, N.Y. This control is designed to supersede the present rope and chain types of control, with the advantages of greater safety to the operator, saving in time (only one man being necessary to operate the crane), and less aisle space required.

The push-bottom station is 20¼ in. long, 2¾ in. wide, and 2 1/16 in. deep, less the projection of the buttons. It is of the proper size to be readily grasped and operated by one hand. The box is of cast aluminum.



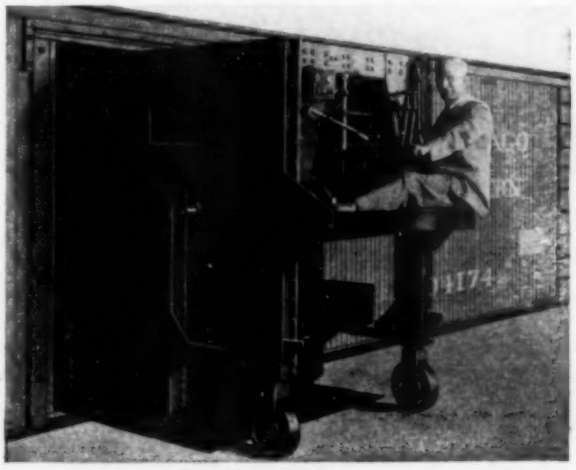
General Electric Push-Button Crane Control for small floor-operated cranes

Edwards Box-Car Loading Machine

For lifting and carrying bundles of sheet metal into and out of box cars, the Signode Steel Strapping Company, 2600 N. Western Ave., Chicago, Ill., has developed a box-car loading machine, which is said to load a 40-ton car with one man in less than 30 min., and has reduced the cost to 2 cents per ton. Two 20-in. bundles of sheets, one on top of the other, may be handled at one time with ease.

The operator does not leave his seat to load, hoist, travel forward or backward, enter or leave a freight car. The bundles are tightly strapped to simple skids with steel strapping. The loading machine is gasoline powered. Broad caterpillar treads at the front spread the load over average types of flooring, and the power unit is mounted on the top, leaving the space between the legs clear to provide a 44-in. lift for the 10-ton hoist.

Any length bundle that can be taken into a car door and turned can be handled successfully. The machine itself is 4 ft. 5½ in. wide, by 5 ft. 9¼ in long, plus 22 in. for the guard and seat, and 7 ft. 2 in. high. The carriers are 8 ft. long and extend about 27 in. beyond the frame of the machine.

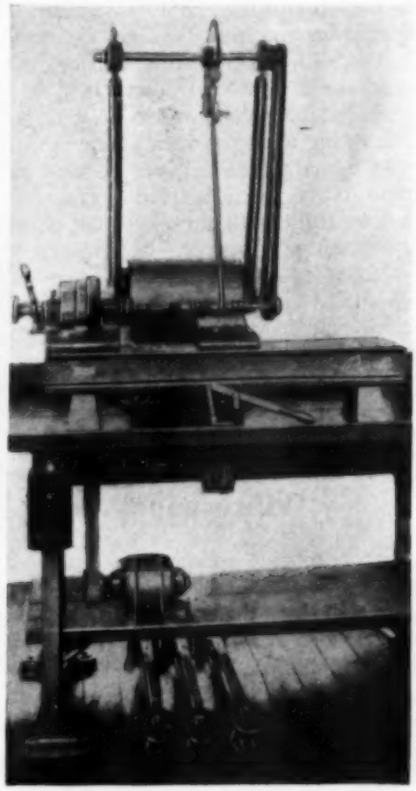


Allen-Bradley Bull. 609 A.C. Starter

For motors of 3 hp., 110 volts; 5 hp., 220 volts, and 7½ hp., 440-550 volts, the Allen-Bradley Company, 1311 S. First St., Milwaukee, Wis., has announced a hand-operated Bull. 609 starter with overload breakers. They are reset with a lever without opening switch cover. The switch can be padlocked in open position if required.

Rivett Bench Lathe for Deep Holes

Rapid drilling of deep holes can be done on the precision bench lathe developed for the purpose by the Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. A revolving-spindle tailstock is employed, driven by a ball bearing grinding countershaft. It is mounted on a unit bench with a ball-bearing, horizontal, safety-drive countershaft and jackshaft. It has the advantage of overhead drive for attachments such as tailstock shown and internal and external bench lathe grinding attachments. Control is by three latch-type treadles giving high speed, low speed, and reverse.



Shakeproof Self-Locking Setscrew

Offsetting the slotted end of the screw so that when inserted the sharp edges bite into the work and exert resistance to any backward movement is the principle employed in the self-locking setscrew recently announced by the Shakeproof Lock

Exaggerated top view of the Shakeproof Self-Locking Setscrew

Washer Company, division of Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill. The locking power can be varied to suit individual requirements. Where it is necessary to have a setscrew that can be removed easily, the degree of offset is reduced; where the product is exposed to intense vibration, the offset can be increased to insure absolute resistance against backing out.

It is said that once this self-locking setscrew is tightened down, it is impossible for vibration to loosen it. The biting action is very pronounced, even when a screw-driver is used to back it out. Aside from the ability to stay tight, and thus keeping parts functioning properly, the setscrew reduces assembly costs, since it eliminates the extra operation of staking it in position. The design principle of this setscrew is patented.

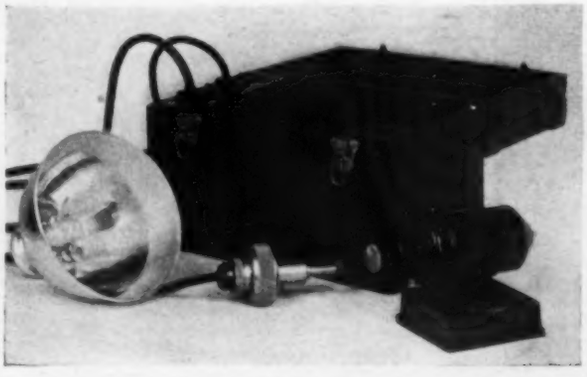
Electrocon Model 3 "Vibroscope"

Stroboscopic action is employed in the Model 3 "Vibroscope" announced by the Electrocon Corporation, 6 Varick St., New York, N. Y. This model has five times the illuminating power of the Model 1, which has been on the market for some years. The motor unit is a new feature.

The Vibroscope is applicable to the study of rotary, reciprocating, or vibratory motions, and in fact, to any type of motion that occurs in repeating cycles, and provided that the hand lamp flashes in synchronism with the motion, or at a low multiple of it. Observations can be made comfortably in the normally lighted laboratory or shop on apparatus running at speeds from 40 to 12,000 r.p.m. The higher speeds can be handled by using the motor unit and running it at a low multiple of the speed of the equipment undergoing tests for performance.

The stroboscopic principle depends upon the interruption of vision between the operator's eye and the mechanism under observation so that he gets a quick glimpse of the mechanism each time it reaches a certain point in its cycle. The result of this quick succession of glimpses, at the same point every time, is to cause the mechanism to appear perfectly stationary at that point. This phenomenon is known as "persistence of vision." A hand neon lamp which produces brilliant light flashes of extremely short duration is used to illuminate the moving mechanism. It consists of an aluminum reflector, which is 8½ in. in diameter, and which houses three neon tubes. The breaker head is driven from the mechanism under observation, and is provided with a rubber and steel driving point such as found on a hand tachometer. An electrical circuit is broken once per revolution at a pair of cam-operated platinum points. A small knurled knob in the breaker head is known as a phase adjuster. By turning this, the neon tubes can be made to flash at different positions in the revolution, so that the moving mechanism may be viewed at different positions in its cycle. The angular position of a mechanism at a critical occurrence can be ascertained.

The Vibroscope forms a part of the Davey portable balancing equipment, but the Model 3 is a potential balancing equipment, being wired to accommodate the Davey Vibrometer, which must be added for that purpose.



"Vibroscope" Model 3 Stroboscope, which is provided with a lamp giving greatly increased illumination. Mechanisms can be studied at operating speeds from 40 to 12,000 cycles per min.

TRADE PUBLICATIONS

ARC WELDING SUPPLIES. The Lincoln Electric Co., Cleveland, Ohio, has issued Section 3304 entitled "Arc Welding Supplies," covering welders, electrodes, protective clothing, and other supplies.

FLEXIBLE SHAFT MACHINES. N. A. Strand & Co., 5001-5009 North Lincoln St., Chicago, Ill., have published a 56-page catalog illustrating and describing new types and sizes of flexible-shaft machines.

FOREMANSHIP REPORTS. Purdue University, Engineering Extension Department, Lafayette, Ind., has issued "A Report of Foremanship Conferences," being Extension Series No. 25.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has issued a series of bulletins as follows: GEA-970B, superseding 970A, on Type PQ Relays; bulletin GEA-1311A, superseding 1311, on electric brazing equipment; GEA-1341 on totally enclosed, fan-cooled induction motors for Class I, Group D, hazardous locations; and bulletin GEA-1351 superseding 992 and 993, on automatic tank and pipe welders.

NITRIDING FURNACE. The Westinghouse Electric & Manufacturing Co., Mansfield, Ohio, has announced the publication of leaflet MN-1296, covering electric bell-type nitriding furnaces and describing the design and operation.

PRESS SAFETY DEVICE. The Positive Safety Manfacturing Co., 4408 Perkins Ave., Cleveland, Ohio, is distributing a bulletin on the "Possons Positive Punch Press Safety Device" showing the operation and giving the construction and output with presses so equipped.

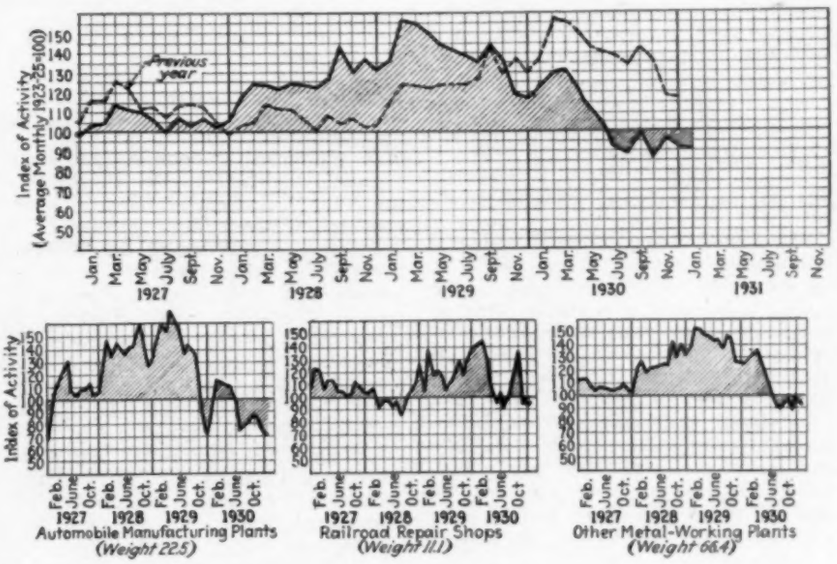
SPEED REDUCERS. The Horsburgh & Scott Co., Cleveland, Ohio, is distributing a circular describing small worm gear speed reducers and listing the horsepower ratings and dimensions.

SPEED REDUCERS. The D. O. James Manufacturing Co., 1114 W. Monroe St., Chicago, Ill., now has available catalog No. 135 on heavy-duty worm gear speed reducers, covering four new small sizes. Complete information is given as to dimensions and horsepower ratings at various speeds.

NEWS OF THE WEEK

January Metal-Working Production Shows Slight Decline in Activity

A FURTHER decline in activity from a final figure of 91.1 in December to 90.1 in January is indicated by reports on the consumption of electrical energy for power purposes. September operations showed a sharp upturn from those of August, but the October decline more than equalled the previous advance. November again showed a sharp advance, but the trend has since been slightly lower. Figures are all corrected for 26 working days. Late December returns from the automotive plants necessitate revision of the index appearing in *American Machinist* of Jan. 22.



The automobile shop index, given originally as 77.9 for December, is corrected to 71.5, slightly less than the 72.9 reported for January. This index shows a slight increase for January, while that for railroad shops shows a decided upturn. The railroad shop index for January is 95.6, as compared with 91.8 in December and 97.8 in November, 1930. Ferrous and non-ferrous metal-working plants outside the two aforementioned classes had a January index of 92.9, as compared with 97.8 in December and 99.4 in December, 1930. The rise in the railroad shops was exactly seasonal, that in the automobile plants was less than seasonal, and the drop in metal-working was sharply against the seasonal trend, which is usually sharply upward in January, except in 1929 and 1930.

These considerations affect the seasonally adjusted figures. The railroad shop adjusted figure is 90.5, as compared with 90.3 in December. The automobile shop adjusted figure is 84.5, as compared with 104.5 in December. The metal-working index seasonally adjusted is 87.9, as compared with 101 in December. This gives a seasonally adjusted general index of 87.7, as compared with 100.5 in December.

Tool Institute Organized in Chicago

The American Machinery & Tools Institute, with executive offices at 40 North Wells St., Chicago, has been organized with the purpose of "promoting the arts and sciences connected with the design, manufacture, or sale of machinery or tools. The results of the work performed by the committees and staff of the Institute are for the benefit of all persons who are engaged in work connected with the design, manufacture, or sale of machinery or tools, and everyone so engaged is eligible for membership." The work of the Institute is planned to include local meetings on the various phases, a trade and public relations department, a trade education department to give instructional courses, a research department, advertising and publicity department, merchandising department, accounting department, legal and legislative department, and service department. Annual conventions and expositions are planned.

Officers include: W. R. Mau of the Vanadium Steel Co., president; F. W. Hack of the Cramp Manufacturing Corporation, vice-president; Mark Miles of Miles & Miles, treasurer; and George R. Tuthill, executive secretary. Other directors include Ira V. Hill, Iver J. Hall, J. W. Harrison, A. H. Brown, and Wm. T. Gunderson.

Screw Machine Products Back Educational Orders

At the last meeting of the Screw Machine Products Association, the following resolution was passed:

"Whereas: The Screw Machine Products Association, (Eastern Division) desires to co-operate fully with the Government of the United States in effecting as quickly as possible, adequate Industrial Preparedness; and

Whereas: It is realized by the members of the Screw Machine Products Association, that in order to properly effect this co-operation it is necessary for them to "educate their several organizations in the manufacture of such material as the various departments of the Government may require of them during a National Emergency; and

Whereas: It is further realized by the Screw Machine Products Association, that only through peace time education in the manufacture of such material, which the factories of the members will be required to produce in war time, will the change over from peace time to war time products most speedily be effected, now therefore be it

RESOLVED: That the Screw Machine Products Association (Eastern Division) hereby endorses the Bill (H.R. 450, 70th Congress) 'To amend section 5a of the National Defense Act, approved June 4, 1920 providing for placing educational orders for equipment, etc.';

and be it further

RESOLVED: That a copy of this resolution be sent to the Chairman of the Committee of Military Affairs, of the House of Representatives, the "American Machinist" and that further copies be provided for the individual members of the Screw Machine Products Association to be sent their representative in Congress."

THE 30th Annual Western Tractor & Power Farm Equipment Show will be held in Wichita, Kansas, Feb. 24-27, under the sponsorship of the Wichita Thresher & Tractor Club, Inc. This show, the largest of its kind, displays a complete line of the latest models of power farm equipment.

Survey Discloses Some Navy Tools Date Back to Civil War

PAUL WOOTON
Washington Correspondent

WASHINGTON, D. C., Feb. 15—In accordance with the practice started last year, the Naval Appropriation bill reported to the House carries a fund of $1,500,000 for bringing the machine tool equipment of the Navy Yards up-to-date. Naval officers informed the appropriations committee that the annual appropriations of $1,500,000 should be continued for at least three more years in order to modernize the machinery thoroughly. The Appropriations Committee was informed that the machine tool equipment of the active Navy Yards has a replacement value of $36,000,000. It is the policy of the Navy Department to replace the equipment on the average at least every 25 years. This replacement period makes necessary an annual allowance $1,500,000 in appropriation bills.

Although most of the appropriation for machine tool purposes will be used for replacements, progress has been so great in some types of equipment, such as welding apparatus, that Navy officers believe that new machinery should be bought in some cases. An inspection trip of the Navy yards disclosed that some of the tools in use dated back to the Civil War.

Lighting Experts To Meet in Britain

American lighting experts and engineers will study the development of lighting and electrical service in Great Britain this Fall at the 1931 International Congress on Illumination just announced by the International Commission on Illumination. The official program covers the period from Sept. 2-19, inclusive. The last International Congress on Illumination was held in the United States in 1928.

Welding Society Formed in St. Louis

On Jan. 23, at a meeting held in the Forest Park Hotel, St. Louis, the St. Louis Welding Society was formed, and officers elected. This society consists of 65 charter members, representing 26 companies in St. Louis, East St. Louis, and Madison, Ill. It is the outgrowth of monthly meetings on the subject of welding, conducted by the Hill Equipment Engineering Co. Temporary headquarters were established at 4620 Delmar Blvd., St. Louis, the home of the Hill company. E. P. Barnes of the Moloney Electric Co., was elected president; W. D. Patterson, of the American School of Welding, vice-president; Basil N. Osmin of the Hill Equipment Engineering Co., secretary and treasurer. The directors include F. J. Feldhaus of the Heine Boiler Co., Geo. Frankey of the Alpha Tank & Sheet Metal Works, A. V. Fausek, of the Modern Engineering Co., Lyman Goodin of the Midwest Piping & Supply Co., F. Tidwell of the John Nooter Boiler Works, and A. E. Eidson of the St. Louis Structural Steel Co.

Future plans of the Society, although not definitely announced, include observation and educational tours through St. Louis factories utilizing welding processes in the fabrication of products and lectures by men prominent in the welding industry.

Yale and A.S.M.E. Study Industrial Problems

The Institute of Human Relations at Yale University, co-operating with leading industrialists and engineers, is preparing to conduct a scientific study of human problems in industry, directed at the roots of unemployment, middle-age obsolescence, labor unrest, and strikes. Announcement of this move was made following a conference at New Haven between a committee of the A.S.M.E., and members of the Institute. Prof. Elliott Dunlap Smith of Yale University will direct this study, while a committee from the Society will serve in an advisory capacity.

Steel Founders Elect New Officers

At the annual meeting of the Steel Founders' Society of America, Inc., at the Hollenden Hotel in Cleveland, W. H. Worrilow of the Lebanon (Pa.) Steel Foundry was elected president of the Society. Vice-presidents elected for the various geographical divisions include: G. R. Casey of the Treadwell Engineering Co., for the Eastern Division; W. W. Powell, of the Mesta Machine Co., for the Central Atlantic Division; Arthur Simonson of the Falk Corporation for the Midwest-Southern Division; Burtner Fleeger of the Oklahoma Steel Casting Co., for the Midcontinent Division. New members elected to the Board of Directors included Frank D. Glosser of the Commercial Steel Casting Co.; F. A. Lorenz, Jr., of the American Steel Foundries; F. J. Stanley, Michigan Steel Casting Co., C. A. Binder of the St. Louis Steel Casting Co.; H. E. Muchnic of the Locomotive Finished Material Co. Those continuing their terms on the Board include William Faison of the Atlantic Steel Castings Co.; J. E. McCauley of the Birdsboro Steel Foundry & Machine Co.; H. J. Koch of the Fort Pitt Steel Casting Co.; Clarence Howat of the Pittsburgh Steel Foundry Corporation; J. T. Osler of the Continental Roll & Steel Foundry Co.; E. H. Cornelius of the Oklahoma Steel Castings Co. T. H. Harvey of the Ohio Steel Foundry Co., was elected Chairman of the Large Castings Division and W. E. Trump of the Machined Steel Casting Co., was elected vice-chairman. The Small Castings Division elected Clarence Tolan, Jr., of the Dodge Steel Co., chairman, and postponed the election of a vice-chairman until the next meeting. The Heat-Corrosion Resistant Alloy Founders Division re-elected T. R. Heward, Jr., of the Duraloy Co., chairman of the Division, and retained the same executive committee in office for another year.

Standards News

NEW MEMBERS of the ASA Standards Council include F. H. Hardin, Assistant to the President of the New York Central Railroad, representing the Mechanical Division of the A.R.A.; E. T. Wood of the Wheeling Steel Corporation, representing the Association of American Steel Manufacturers' Technical Committees; Dr. Alfred N. Goldsmith, Vice-President and general engineer of the Radio Corporation of American, representing the I.R.E.; W. S. Paine of the Engineering & Inspection Department, Aetna Life Insurance Co., representing the National Bureau of Casualty and Surety Underwriters; Dr. Zay Jeffries of the Aluminum Company of America, representing the Light Metals group, and Lewis K. Sillcox, Vice-President of the New York Air Brake Co., representing the A.S.M.E.

The Standards Council of the American Standards Association will meet on March 12, June 11, and Sept. 17 of the current year. The date for the joint annual meeting of the Board of Directors and Standards Council will be determined later.

The A.S.A. will soon being work on the development of national standard specifications for leather belting. Work on the project will be undertaken immediately by a technical committee made up of representatives of manufacturers, distributors, and users in government departments. The A.S.M.E. will direct the technical work under the procedure of the A.S.A.

THE chapter on "Fabrication of Hangers, Supports, Anchors, Sway Bracings and Vibration Dampeners" of the proposed Code for Pressure Piping of the A.S.M.E. is being distributed to industry for criticism and comment. The material is in tentative form and suggestions will be welcomed by C. B. LePage, 29 West 39th St., N. Y. C.

Screw Machine Data Given by Census

Manufacturers of screw-machine products and wood screws sell principally to industrial consumers. Of the total sales in 1929 amounting to $103,182,000, 79.9 per cent, or $82,476,000 was made in that way. The remaining sales were made as follows: 17.8 per cent, or $18,297,000, to wholesalers, and 2.3 per cent, or $2,409,000, to retailers. Of the total sales, 8.1 per cent, or $8,385,000, was made through manufacturers' agents, selling agents, brokers, and commission houses. This report covers the sales of the 264 establishments engaged primarily in the manufacture of screw-machine produces and wood screws and as such includes the distribution of $14,653,470 worth of secondary products made by these manufacturers, according to the Census of Manufactures.

Safety Conferences Scheduled

A number of Safety Conferences have been definitely scheduled for the coming six months. These include a conference on Feb. 19 and 20 for the State of Pennsylvania, the Greater New York Safety Conference on Feb. 25, Mid-West Safety Congress in Chicago on March 5, Pittsburgh Safety Engineering Conference on April 17, All Ohio Safety Congress from April 21 to 23, Eastern Safety Conference in Newark, N. J., on April 23, Massachusetts Safety Conference in Boston on April 29 and 30, Rock River Valley Safety Conference in Rockford, Ill., on May 1, Northwestern Pennsylvania Safety Conference on May 21, and Central States Safety Congress in St. Louis on April 13 and 14.

INVENTORIES of 644 corporations in 27 different lines of industry and miscellaneous at the close of 1930, amounted to $1,016,213,746 and were in the aggregate 17.64 per cent less in dollar value than at the close of 1929, and 5.65 per cent less after adjustment for estimated price recessions, according to a preliminary survey made by Ernst & Ernst, accountants. The dollar value of sales of the same companies for 1930, the survey showed, was $6,411,904,456, a decline of 15.12 per cent from 1929.

AMERICAN Tentative Standard (G8c-1930) on Zinc Coatings on Structural Steel Shapes, Plates, Bars, and their Products, has been approved by the A.S.A.

FEDERAL specifications for various kinds of packing are now being submitted to industry for criticism and comment. Corrections must be received within about eight weeks.

BUSINESS ITEMS

The Watson-Stillman Co., Roselle, N. J., has appointed the Moorlane Co., Tulsa, Okla., exclusive representatives for the sale of hydraulic machinery and accessories in the State of Oklahoma.

The Illinois Testing Laboratories, Inc., 141 W. Austin Ave., Chicago, Ill., has appointed Porter Hurd, 516 Packard Bldg., Philadelphia, Pa., as its representative in Eastern Pennsylvania, Southern New Jersey, Delaware, and Maryland.

Sargent & Co., New Haven, Conn., has merged with the Belleville (Ont.) Hardware & Lock Mfg. Co., Ltd., and the new company will operate as Belleville-Sargent & Co., Ltd.

W. L. Brubaker & Bros. Co., Millersburg, Pa., and the Wm. H. Ottemiller Co., York, Pa., have been licensed to manufacture Dardelet self-locking screw threads by the Dardelet Threadlock Corporation, 120 Broadway, New York City.

The Geometric Tool Co., New Haven, Conn., has appointed the J. H. Ryder Machinery Co., Terminal Warehouse Bldg., Foot of York St., Toronto, Ont., as agent for the Province of Ontario.

The Miller Co., Meriden, Conn., has placed foreign rights for their Duplexalite products in France with the Compagnie Des Lampes of Paris. Sales rights in Spain, Portugal, Greece, Czecho-Slovakia, and Poland have been granted, also.

Headquarters of the Cherry Burrell Corporation of Canada, will be moved from Toronto to Brockville, where the concern has operated a branch plant for some years. Sales and factory operations are to be consolidated in Brockville.

Ogden R. Adams, Rochester, N. Y., is moving his machinery storage and display rooms to 316 Broad St. at the corner of Oak, as of March 1.

The D. D. Terrill Saw Co., Bangor, Me., is establishing a branch factory at Pembroke, Ont., where it will manufacture buck saws of all styles, band saws, mill saws, and practically all styles of saws and saw tools. The Canadian branch will be managed by K. M. Smith.

The Winchester Repeating Arms Co., New Haven, Conn., William Tobler, receiver, has been granted authority by Federal Judge Edwin S. Thomas to accept orders totaling $3,000,000. The receiver was also given permission to fill $125,000 worth of advertising contracts through the next six months. The Kidder-Peabody Co., New York, is allowed to retain title to $127,000 worth of copper and lead, purchased for the Winchester Co. under trust certificates.

The Advance Rumely Co., and the Indiana Farm Machinery Co., La Porte, Ind., have received formal approval for their merger, the new company to be known as the Advance Rumely Corporation.

Arrangements have been made for the establishment in Walkerville, Ont., of a new industry, the Lodge Motor Co. The concern is a subsidiary of the Lodge Motor Co., Detroit, and will manufacture marine engines. Factory space has been secured and machinery is now being placed. It is expected the plant will be in operation about the beginning of March.

The Steel Roll Repairing Co., Fall River, Mass., has begun operations on repairing textile machinery.

Lincoln Electric

SILENT SEAMING

John A. Gledhill, trading as the Gledhill Manufacturing Co., Providence, R. I., will have all assets sold at public auction on Feb. 25.

American Cirrus Engines, Inc., Marysville, Mich., has been reorganized and will commence production at once. W. R. Blacklock, formerly secretary-treasurer, has been placed at the head of the new company. The reorganization is the result of a sale by public auction of the plant, the winning bulk bid of $105,500 being made by the Great Lakes Aircraft Corporation, a subsidiary of Allied Motor Industries, Inc. The American Cirrus Engines, Inc., was also a subsidiary of this same holding company.

PERSONALS

Dr. Lawrence W. Bass has resigned as executive assistant director of the Mellon Institute of Industrial Research, Pittsburgh. Dr. Leonard H. Cretcher, Head of the Department of Research in Pure Chemistry since 1926, has been appointed to an assistant directorship and will be assisted by Dr. William L. Nelson.

L. G. Bassett has been appointed district manager of the Ontario district office for the English Electric Co. of Canada, Ltd.

W. Hubert Beal, formerly vice-president and general manager of the Lycoming Manufacturing Co., Williamsport, Pa., has been elected president to succeed John H. McCormick, who resigned on Jan. 13. Frank M. Bender, assistant general manager, has been appointed vice-president to succeed Mr. Beal.

F. C. Biggert, Jr., Vice-President of the United Engineering & Foundry Co., Pittsburgh, Pa., has been appointed a member of the A.S.M.E., Research Committee for the term 1930-1935. Mr. Biggert takes the place made vacant by the retirement of Robert L. Streetor, Vice-President of the U. S. Aluminum Co., Pittsburgh, Pa.

Robert De Forrest Boomer, who for the last 12 years has been identified with E. H. Rollins & Sons, New York, was elected a director of the J. G. White Engineering Corporation of the same city on Jan. 27.

Dr. George K. Burgess, Chief of Staff of the Bureau of Standards, U. S. Department of Commerce, will explain in detail the work and duties of his branch of the Federal Government before the Akron-Canton local section of the A.S.M.E. on Feb. 27.

E. L. Cord has been elected chairman of the board of directors of the Auburn (Ind.) Automobile Co., and R. H. Faulkner has succeeded him as president.

F. J. Haynes, who recently joined the H. E. Franklin Manufacturing Co., as vice-president, has been elected chairman of the newly organized executive committee. Other members are F. A. Barton, Secretary, and Ralph Murphy, Treasurer.

Rufus N. Hemenway, Vice-President of the Fafnir Bearing Co., New Britain, Conn., has been elected president of Fafnir Bearings, Inc., an affiliated company manufacturing railroad bearings exclusively. A. L. Maltman and R. R. Searles were elected vice-president of Fafnir Bearings, Inc., and Alfred G. Way was named secretary-treasurer of that company.

W. M. Horton has been appointed assistant general factory manager of the Lamson & Sessions Co., Cleveland, H. L. Judd has been made manager of the West 85th St., plant, formerly Kirk-Latty Manufacturing Co., and G. E. Rappert, manager of the East Sixty-third Street plant, formerly Lake Erie Bolt & Nut Co.

Phil Huber has been appointed vice-president and assistant general manager of the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit. He has been with the company since its organization, and was made factory manager in 1929.

R. B. Jennings, formerly general manager of Robert W. Hunt & Co., Ltd., has been appointed railroad representative of Crane, Ltd., with headquarters at Montreal.

J. P. Jordan, of Stevenson, Jordan & Harrison, New York, N. Y., was the principal speaker at a dinner meeting on Feb. 6 of the Management Division, Metropolitan Section, A.S.M.E. Mr. Jordan's subject was "The Scope of Management in the Future." Ernest Elmo Calkins, President of Calkins & Holden, will speak on "Consumer Engineering" at the April 16 meeting of the division.

George K. Hull, Assistant Plant Superintendent of the Brooks works of the American Locomotive Co., Dunkirk, N. Y., has been appointed general plant superintendent, succeeding John S. Stevenson, who has been named general manager. Robert P. Allison, formerly general manager of the Brooks plant, has been appointed general manager of the Schenectady plant.

Edwin A. Jones, Treasurer and General Manager of the Globe Iron Co., Jackson, Ohio, was elected vice-president to succeed the late Moses Morgan on Jan. 21. He will continue as treasurer and general manager. John E. Jones was re-elected president and Charles P. Chapman secretary.

H. Dudley Jones has succeeded Philip P. Brown, in charge of the Steel Department of the Wilkoff Co., Youngstown, Ohio, as of Jan. 15.

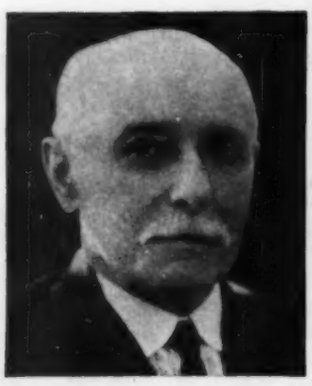
Louis O. Klingelhofer, Vice-President of the Pittsburgh (Pa.) Bridge & Iron Works, was also made treasurer at a recent meeting of the board of directors. H. N. Trimble was elected a vice-president and Fuller F. Ross was made secretary.

W. A. Kohlhoff has been appointed a sales engineer of the Hydrauger Corporation, Ltd., 495 Eleventh St., San Francisco, Calif.

W. M. Levett, Vice-President and General Manager of the Welker-Hoops Manufacturing Co., Middletown, Conn., and president of the Continental Casting Co., a subsidiary, has resigned.

Joseph Millard, President of the Extruded Metal Products Co., Bridgeport, Conn., sailed recently for London to superintend opening operations of two brass foundries in England.

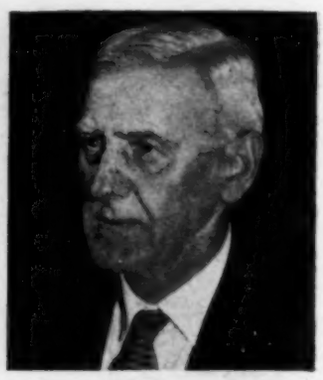
New Officers, Cleveland (Ohio) Pneumatic Tool Company



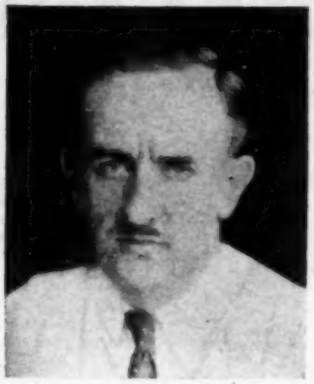
Claus Greve
Chairman of the Board

L. W. Greve
President

John De Mooy
Treasurer



Arthur Scott
Superintendent



J. C. Russell

C. I. Ochs has been appointed president of the Wilcox-Rich Corporation. Mr. Ochs has been a director for some time and is also president of the Eaton Axle & Spring Corporation, Cleveland, which is affiliated with Wilcox-Rich. C. W. Miller has been appointed vice-president and general manager for Wilcox-Rich. He was formerly vice-president, Thompson Products Co.

Herbert M. Orschel has been appointed field sales manager of the Aeroil Burner Co., Inc., Park Ave. at 13th St., New York, N. Y.

J. C. Russell, formerly assistant general superintendent of the Cincinnati Works, Worthington Pump & Machinery Corporation, Harrison, N. J., has been appointed production manager. R. L. Rickwood has been appointed general superintendent, and A. V. Saharoff works engineer.

Ellis W. Ryan, Vice-President of the Auburn Automobile Co., and president of the Central Manufacturing Co., Auburn Body Plant at Connersville, Ind., has resigned because of ill health.

Allen Seymour of the Norton Company, Worcester, Mass., spoke on "New Developments In The Abrasive Industry" at the Feb. 10 meeting of the Hartford chaper, A.S.S.T.

W. F. Slomer, general sales and service manager of the Fellows Gear Shaper Co., Springfield, Vt., will move to 616 Fisher Bldg., Detroit.

R. H. Smith, Toronto, Ont., has been elected chairman of the Algoma Steel Corporation, Sault Ste. Marie, Ont., a subsidiary of the Lake Superior Corporation, Montreal, Que.

Wilfred Thompson, formerly manager of the F. F. Barbour Machinery Co., Toronto, Ont., has been appointed sales manager of the Vulcan Engineering Co., Jackson, Mich., with headquarters at 16874 Burwood St., Detroit.

H. N. Trimble, for the past ten years a director of the Pittsburgh Bridge & Iron Works, has been elected a vice-president and member of the executive committee.

E. E. Wilson, President of the Sikorsky Aviation Corporation, Stratford, Conn., has been elected president of the Chance-Vought Corporation, East Hartford, Conn., to succeed A. C. Dickinson, who becomes chairman of the board. Mr. Wilson is also president of the Hamilton Standard Propeller Co., Pittsburgh, Pa.

Lewis L. Warriner, formerly manager of factories for Fairbanks, Morse Co., Beloit, Wis., has become vice-president and factory manager for the Master Electric Co., Dayton, Ohio.

Robert S. Winter, formerly production manager with the Freeman Motor Co., Detroit, has become an experimental engineer with the Brunswick Radio Corporation, Muskegon, Mich.

Andrew W. Woodman was elected president and director of the National Steel Tank Co., Bradford, Ill., at the annual meeting on Jan. 20. Ralph M. Powers of Kewanee, Ill., was elected vice-president and director, Rudolph D. Lackman, treasurer and director, Dean W. Woodman, secretary and director, and Earl T. DeMoe, Evanston, Ill., a director.

OBITUARIES

Albert T. Nolan, General Foreman of the Standard Steel Car Corporation, died recently at his home in Butler, Pa., following an illness of two months. He had been identified with the company for 28 years.

Frank H. Brooks, 62, former president and director of the E. & T. Fairbanks Scale Co., died at Newton Highland, Mass., on Feb. 7. He retired in 1917.

John A. Cave, Secretary and Assistant Treasurer of the Brown & Sharpe Manufacturing Co., Providence, R. I., died on Feb. 5. He had been with the company since 1905, since 1924 in his present office.

James Clark Brainard, 66, Secretary of the Johnson-Jennings Co., Cleveland, died on Feb. 7 at Mt. Clemens, Mich., after an illness of several months.

Alexander Darracq, 75, pioneer automobile manufacturer, died in Monte Carlo on Feb. 11.

Samuel D. I. Emerson, 45, efficiency expert and one of the founders of The Emerson Engineers, 30 Church St., New York, N. Y., died of heart disease on Feb. 8.

Edward Gagel, 73, chief engineer of the New Haven Railroad for the last 24 years and a railroad man for 56 years, died in West Haven, Conn., on Feb. 11 of heart disease after an illness of several months. He retired two years ago.

Albert H. Hicks, 78, who had been associated with the former Hicks Locomotive & Car Co., Chicago, for many years, died on Feb. 5 at Taylorville, Ill. He retired 12 years ago.

Christian Jensen, Vice-President and General Superintendent of the Harvey Spring & Forging Co., Racine, Wis., died on Feb. 2 after a short illness.

Sir Charles A. Parsons, 76, inventor of the modern steam turbine and one of the world's foremost shipping engineers, died at sea on Feb. 12. He was the developer of the principle of "pressure-compounding." He had recently completed the design of the engines of the "Acheron" new British torpedo-boat destroyer, which is 10 to 15 per cent more economical than other ships of her size.

FORTHCOMING MEETINGS

STEEL FOUNDER'S SOCIETY OF AMERICA—Sales clinic and regular meeting, March 19-20, Neil House, Columbus, Ohio. G. P. Rogers, Managing Director, 932 Graybar Bldg., New York City.

THREE-M-CONGRESS — Management, Maintenance, and Materials Handling Congress and Second National Industrial Equipment Exposition, Cleveland, Ohio, April 13-18. 1931. In the Arena and Exhibit Hall, Cleveland Public Auditorium. Information from the A.S.M.E., 29 West 39th St., N.Y.C.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

NATIONAL FOREIGN TRADE COUNCIL—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2, (approximate, exact dates later). Theme "Control of Manufacturing Overhead." Headquarters, 20 Vesey St., N. Y. C.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary-treasurer.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

Again there was little change in the condition of the market. While some dealers reported a slowing, others reported a better week, with the average remaining about even. Orders are principally of the single-tool-for-replacement variety. Inquiries have shown some improvement. An outstanding reason for better feeling was the Delaware & Hudson list for the Watervliet shops, containing about six tools, including a 24-in. lathe, turret lathe, shaper, and radial drill. Although said to be purely for budget purposes, dealers in general were somewhat heartened by its appearance, coupled with better conditions on "the Street" and reports of upturns in general business. There are still some school orders, but municipal orders have fallen off since the first of the year.

NEW ENGLAND

The machine tool situation marked time over the current week. Aside from stronger activity in the grinding machine market, nothing of note developed. Buying was again limited to a scattered distribution of single machines. Prospective requirements are encouraging, but closings are very indefinite. Strong competition and increased buying interest over all new orders tends to overemphasize actual new business.

Industrial schedules are fairly well maintained. There are still too many instances of curtailing, but gains in other centers more than balance declines. The woodworking industry has developed new life. A Ware, Mass., machine builder in this line has fine orders for heavy equipment, assuring full schedules for two or three months.

CINCINNATI

Indications that better business is in the offing are seen by some manufacturers. Bookings of the past week were at about the same level as they have been for some time past, but sales resistance is showing signs of weakening. Sales agents report a shade better demand and feel that an upward market trend is beginning. The week's business was largely confined to the sale of single tools and replacements to general machinists and miscellaneous users. The week's inquiries are regarded as more promising than they have been for many months, and on this fact the belief that a better market is developing is based.

LOS ANGELES

As the middle of the first quarter of the new year is approached there is little in the way of new business to be reported. In other words, the situation remains much the same as recorded in the last letter from this locality. Tools are being sold here and there, miscellaneous orders, with occasionally several tools on one order. As is generally known, the oil industry forms the basis upon which many local activities are largely dependent. Machine tool distribution here can hardly be expected to resume former proportions until the plants serving the oil fields are again active.

INDIANAPOLIS

Demand seems limited to a few favored industries in which demand is fairly good and perhaps will exceed the volume done in the first quarter of last year. In fact, with the quarter half gone, the trade believes there will be a gradual expansion during the year.

Just now there is a lot of good business being sold to the sand and gravel industry and more inquiries are being received. It is thought much more equipment will be sold to these plants this year than last. A big amount of expansion work contemplated by the gas industry has made manufacturers of pipe a little busier than they were last year, and they are buying some equipment. The remainder of the iron and steel trade in Indiana does not seem so flourishing.

In all instances there is much haggling over prices. The buyers use every effort to force down price levels on machinery, and with some success since the machinery manufacturers and dealers are fighting pretty hard for business.

Railroad demand has been disappointing during the entire winter and no extensive lists have been published. Automobile factory demand also is discouraging, though some small orders are being purchased. A fair demand is seen for small equipment for the airplane fields in the state and the volume of inquiries being received for garage equipment also is increasing.

■

BUSINESS seems on an upward trend, but business men continue to appear nervous and jumpy, like gentlemen of color in a cemetery. Improvement is reported from various fields, but the major trouble seems still to be Capital's antipathy to dotted lines. Inquiries, however, continue to come in, among them, more and more frequently, a list.

NEW YORK'S market, while more optimistic, is unchanged. Inquiries, including a 6-tool D. & H. "budget" list, are improving, and general business is up a trifle. New England sales are principally scattered single tools, although wood-working machines are going better. Cincinnati reports signs of weakening sales resistance, while some manufacturers, and most dealers, see the beginning of an upward trend well sprinkled with inquiries. Los Angeles, however, resignedly awaits some sign of activity from the oil industry, selling a few tools here and there meanwhile. Indianapolis demand, limited to a few favored industries, will, nevertheless, give a sales volume above the first quarter last year. There, in common with other sections, are evidences of price-cutting. Orders are from sand and gravel, pipe, airplane fields, and garages.

DETROIT'S outlook is brighter than for many moons, with actual orders increasing and February looking better than January. Chicago inquiries are off, sales are marking time, and prospects are awaiting 'better times," though a 9-tool inquiry has come from the Chicago Great Western Railroad. Canada reports business picking up all along the line, but expects little tangible return until the second quarter, though railway, aircraft, electrical, structural, and excavating companies are buying an occasional tool.

DETROIT

With automobile sales still increasing and with the optimism of the automobile and accessory manufacturers become more solidly established, the outlook for the machinery and machine tool trade is brighter than it has been in a good many months. The last three weeks have brought signs of improved conditions, but much of the apparent advancement has been discounted because it seemed transient. Now that conditions are still improving there is much more reason to believe the growth is substantial.

Actual orders for machinery and equipment are increasing in size and in number, but this is not the major cause for the mental improvement. The attitude of the automobile industry has produced the greatest optimism. Not only are the engineering departments of the large companies unusually active but the purchasing departments are alert and are more responsive than they have been at any time in the past 15 months.

January automobile sales bore out the favorable predictions made early in the month. The sales for February to date are apparently even better and there is a great deal of evidence to indicate that the advancement is a tangible and permanent one.

CHICAGO

Progress toward a more active market appears to have halted somewhat during the last week. Inquiries are not being received in quite so good a volume as in January, and bookings are reported to be few and far between. Repair parts for standard tools constitute a good share of the business, which is interpreted as indicating that the buying of new tools is being deferred until general industry shows a more appreciable tendency toward greater production. Notwithstanding this situation, the feeling among the trade continues optimistic, the attitude being one of watchful waiting. A few concerns report business thus far in February as comparing favorably with that of the same period in January, one company, specializing in gears, reporting an increase of 40 per cent. A complaint frequently heard is that heavy price cutting is being generally resorted to in the effort to close sales. The Chicago Great Western Railroad is in the market for the following equipment for its Oelwein (Iowa) shops: a 36-in. shaper with attachments; a 24-in. turret lathe; a 12x2-in. electric floor grinder; an 18x3-in. electric floor grinder; a 15-in. sensitive drill; a 36-in. engine lathe; a 4-ft. radial drill; a 20-in. lathe, and a 25-ton bushing machine.

CANADA

Very little change has been noted during the last fortnight. Business is picking up slowly all along the line, but indications are that it will be well into the second quarter before there is any appreciable improvement. There have been some fair-sized orders for machinery for new industrial plants in the Toronto district, while in other sections there has been a good demand for used tools since the first of the year.

Railroad contracts are expected to keep manufacturers of transportation equipment busy for several weeks. The Federal Government has placed contracts with various Canadian aircraft companies to the amount of approximately $500,000, and other new business during the last two weeks includes orders for electrical, structural, and excavating equipment for the Beauharnois power development on the St. Lawrence, and an order from the Canadian Pacific Railway for 30,000 tons of heavy rails to be manufactured by Algoma.

BUSINESS • BAROMETER

The world's present problem is to get itself reorganized, and it is making some progress

THEODORE H. PRICE
Editor, Commerce and Finance, New York

AMONG last week's happenings the most important include:

1. A rally in silver after it had declined to 12d. per ounce in London, lowest price on record. A movement to do something for silver has been started in the United States Senate, and London cables intimate the probability of an agreement by sellers of the white metal to restrict amounts offered. This agreement, it is believed, would have the co-operation of the Indian government, which thus far has been severely criticized for its untimely selling.

2. A succession of congressional flare-ups at Washington which are pessimistically regarded by some, although it seems unlikely that a special session will have to be called. Most of the issues in controversy, including the question of bonus certificate payments, are being successfully compromised.

3. Rumors which suggest that a revolution impends in Russia, and that some of the threats to European peace are becoming increasingly serious. These rumors are denied, but there are many who believe them and insist that they have a veracious basis.

4. A continuation of easy money in New York, and buoyant markets for stocks and bonds, as well as for some commodities.

5. A bullish enthusiasm which was striking early in the week, and was but slightly cooled by some of the rumors mentioned. But there does not seem to be any real basis for immediate alarm, and it is just as well to recollect that war costs men and money, of which the world has but little to spare at present. *Manana* is a word which bespeaks the attitude of militant Europe toward another conflict just now, and we need not take much stock in the bellicose predictions which emanate from some of the European politicians.

The world's present problem is to get itself reorganized, and it is making some progress in this direction, as witnessed by the slight improvement in trade that was observable last week.

Car loadings showed a slight increase. The gain does not amount to much, but a prominent railway officer is said to have remarked that we were not likely to require red ink much longer. Day by day his confreres are confirming his statement. Of course, we are not going to get a country-wide revival of speculation in the near future, but the American investor likes to see the plus sign on the doors of the enterpises that he finances. The effect of this sign upon the national attitude is amazing. As has been often pointed out in these letters, hope is a wonderful stimulant. Too much of it may lead to excesses, but a little of it is essential as an antidote to fatigue. With the adjournment of the present Congress, which now seems probable, a summer of cheerfulness ought to be ours, and if this cheerfulness extends itself to Europe and the Orient, a boom may be seen.

The facts with regard to unemployment on the Continent are hard to obtain, but personal friends who have been traveling extensively in Germany say that there is but little distress to be seen.

In the United States the advance in stocks and bonds is attracting wide attention. It is to be hoped that it will not go too far, as it may provoke a reaction that would be really depressing. Most of the commodity markets are higher. This is particularly true of cotton. People are buying it upon the theory that it has become cheap, and some speculators insist that Great Britain will have to find a way to remonetize silver in the Far East. Just how this can be done is a question, but we seem to be stabilizing everything, and silver should not be overlooked, at least in so far as the Orient is concerned. If the plans now being talked about to help the market are carried out an expansion of trade ought to follow.

In industrial news the most encouraging item is an increase in the number of blast furnaces in operation and the signs of a slight betterment in the iron and steel industry. The automobile and tire factories have been speeded up a little more though their output is still subnormal. Building is slow, but is holding its own fairly well in comparison with last year when the total of street and road construction is added in. Copper was quickly marked up again when a price reduction brought in large orders. The improvement recorded is attributed to some special causes in each particular case, but it is beginning to look as if the real reason were a belief in direct or indirect inflation, as the only way out of a financial *cul de sac* in which some of the world's governments have involved themselves.

This suggestion will, of course, be disparaged by those who deny the existence of inflation, but a very brief study of the world's gold and silver reserves will reveal the fact that some nations have very little gold while others are burdened with an oversupply. As a result the British financiers are calling for a readjustment, which would be made unnecessary if the billion men and women who inhabit India and China were supplied with the currency that they need and are entitled to. If a policy that would correct this feature of the situation were adopted, a real boom that would last through more than one administration would soon be initiated.

THE BUSINESS WEEK

February 18, 1931

Stock-market stories have blossomed on dreary front pages this week like sudden surprising crocuses under the sooty snow of the front yard. . . . Well, who knows? . . . After a long, hard winter shut up in the barn, on very little hay, with the bears prowling outside, the herd of commerce can't be expected to sniff cynically at the snort of a bull, even though it be a mere technical snort. . . . Evidences of much trade improvement are still slight, but perhaps sufficient to excuse the eager turn of sentiment. . . . A rising backlog of steel orders, somewhat better than seasonal levels in car loadings, bank debits, currency in circulation, and commercial loans, a firming of some commodity prices, and increasing bank bond investments are encouraging. . . . Yet our index of general business for the first week of February at 76.8% of normal (preliminary) shows little change from the low level at the end of January. . . . The passing of the bonus bogey, settlement of the relief squabble, and prospects of early lifting of the congressional incubus probably have helped betterment of business feeling. . . . Revival of the Russian embargo agitation and renewed disturbances in Germany, however, suggest that some of the larger problems looming in the background have still to be reckoned with before the early spring flowers of the stock-market will be safe from frost.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

BUYING of steel sheets has gained perceptibly in the last week, particularly in the East. Demand for black and blue-annealed exceeds that of the galvanized. Sheet prices at both mill and warehouse are steady. Copper advanced ¼c. per lb., to 11¼@11⅜c., in small lots out of New York warehouse. This rise in the raw metal may serve to check the falling prices of fabricated brass and copper as well as those of scrap non-ferrous metals, which declined during the last week. Copper wire and scrap light brass and zinc remain as exceptions to the decline.

(*All prices as of Feb.* 13, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	20.41@ 20.91
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	13.00@14.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@ 19.26
Virginia No. 2 (Silicon, 1.75@2.25)	22 29
Basic	17.25@ 17.50
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.51
PITTSBURGH: (including freight charge, $1.76, from Valley)	
No. 2 Foundry	18.76
Basic	18.76
Bessemer	19.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4 75@5.00
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.25†
No. 12	1.95	3.45†	3.10	3.30†
No. 14	2.05	3.55†	3.20	3.35†
No. 16	2.15	3.65†	3.30	3.45†
Black				
Nos. 18 to 20	2.15@2.25	3.60†	3.40	3.30
No. 22	2.30@2.40	3.75†	3.55	3.45
No. 24	2.35@2.45	3.80†	3.60	3.50
No. 26	2.45@2.55	3.90†	3.70	3.60
No. 28	2.60@2.70	4.05†	3.85	3.75
Galvanized				
No. 10	2.20@2.30	3.65†	3.50	3.35
Nos. 12 to 14	2.30@2.40	3.75†	3.60	3.40
No. 16	2.40@2.50	3.85†	3.70	3.50
No. 18	2.55@2.65	4.00†	3.85	3.65
No. 20	2.70@2.80	4.15†	4.00	3.80
No. 22	2.75@2.85	4.20†	4.05	3.85
No. 24	2.90@3.00	4.35†	4.20	4.00
No. 26	3.15@3.25	4.60†	4.35	4.25
No. 28	3.40@3.50	4.85†	4.70	4.50

*Light Plates. †400 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

—Thickness— Decimal	B.w.g. and Fractions	¼	⅜	½	⅝	1	1⅛	1¼
		—Outside Diameter in Inches— Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.75†	4.00	3.75†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.85†	5.30	5.00†
Cold fin., round or hexagon‡	3.40	3.65	3.35
Cold fin., flat or square‡	3.90	4.15	3.85
Structural shapes	3.10†	2.95	3.00†
Soft steel bars	3.10†	2.95	3.00†
Soft steel bar shapes	3.10†	2.95	3.00†
Soft steel bands	3.40†	3.20	3.20†
Tank plates	3.10†	3.00	3.00†
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	65%	55%	50%

*Flat, 1/16-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—3/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ¼, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			11.25@11.75
Tin, Straits, pigs, New York			29.00@30.00
Lead, pigs, E. St. Louis	4.30	New York	5.87½ @6.87½
Zinc, slabs, E. St. Louis	4.05	New York	5.50 @ 6.50

	New York	Cleveland	Chicago
Antimony, slabs	10.00@10.50	10.50	10.75
Copper sheets*	19.25	19.25	19.25
Copper wire*	11.50	11.62½	11.62½
Copper, drawn, round*	17.75	17.75	17.75
Copper tubing*	21.62½	21.62½	21.62½
Brass sheets, high*	16.62½	16.62½	16.62½
Brass tubing, high*	21.50	21.50	21.50
Brass rods, high*	14.87½	14.87½	14.87½
Brass wire, high*	17.12½	17.12½	17.12½

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.00@25.00	24.30	23.30
Zinc sheets (casks)	9.75@10.25	11.25	10.36
Solder (½ and ½)	22.00	21.50	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	45.50
Commercial genuine, intermediate grade	34.50
Anti-friction metal, general service	29.00
No. 4 babbitt, f.o.b.	10.00

†F.O.B.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.50	7.75	7.25@7.75
Copper, heavy, and wire	7.00	7.50	6.75@7.25
Copper, light, and bottoms	6.00	6.50	6.00@6.50
Heavy lead	3.25	3.50	3.00@3.50
Lead battery plates	1.25	2.50	2.00@2.50
Brass, heavy, yellow	4.00	4.50	4.00@4.50
Brass, heavy, red	6.50	7.00	6.25@6.75
Brass, light	3.50	3.25	3.50@4.00
No. 1 rod-brass turnings	4.50	4.50	4.25@4.75
Zinc	1.50	1.50	1.25@1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13	$0.16	$0.15
Cotton waste, colored, per lb.	.09½	.12	.10
Wiping cloths, washed, white, per lb.	.15	38.00 per M	.14½
Sal soda, per lb.	.01½	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.096	.099	098
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30–5%	40%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	70%	50–10%	60%
Second grade	65–5%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.031	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1487½	.1562½	.2125
Solder (½ and ½)	per lb.	.22	.215	.2975
Cotton waste, white	per lb.	.13	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.65	.65
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65–10%¶	65%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.40@2.50		
Coke, prompt foundry, per net ton	Connellsville, 3.25@4.85		
White lead, dry	100 lb. kegs	New York, 13.25	
White lead, in oil	100 lb. kegs	New York, 13.25	
Red lead, dry	100 lb. kegs	New York, 13.25	
Red lead, in oil	100 lb. kegs	New York, 14.75	

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from latest list, dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65–10%
Larger, up to 1 x 30-in., full kegs, list less	65–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65–10%
Larger, list less	65–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.25
Structural, round head, broken kegs, net	5.75
Tank, 7/16-in. dia. and smaller, list less	60–10%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65–10%
Larger, up to 3-in., list less	65–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$3.50
Wrought, broken kegs, per 100 lb., list less	1.50
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

La., New Orleans—New Orleans Public Service Inc., 317 Baronne St.—construction program for 1931 includes tools, to cost $5,000.

Mass., Boston—Gerard Electric Co., 101 Pearl St.—lathes, drilling machines, screw cutting machines and various metal working machines.

Mass., Boston—Navy Dept., Washington, D. C.—will receive bids until Feb. 24 for electric furnace for Navy Yard here.

Mass., Cambridge (Boston P. O.)—New Method Die Co., 30 Cross St.—two bench kick presses.

Mich., Detroit—D. A. Chamberlain, 5237 Loraine Ave.—medium thread cutting bench lathe.

Mich., Detroit—Dept. of Purchases & Supplies, 735 Randolph St.—will receive bids until Feb. 21, one Tahara "A" burnishing machine.

N. H., Portsmouth—Bureau of Yards & Docks, Navy Dept., Washington, D. C.—electric bridge crane. $50,000.

N. J., Newark—Bd. of Education, Essex County Vocation Schools, Hall of Records — will receive bids until Feb. 23 for equipment and supplies including machine and hand tools, etc.

O., Ashtabula—Battery Sales & Service Station—electrical test bench lathe and tools for electrical shop.

Opportunities for Future Business

Ariz., Kingman—Glenidick Mines Corp., c/o H. Derrer, Mgr., plans the construction of a 50 ton cyanide mill.

Calif., Los Angeles—Los Angeles School District, awarded contract for the construction of a high school including 78 x 155 ft. shop building, etc., on Robertson Blvd. $367,880.

Calif., Mare Island—Bureau of Yards & Docks, Navy Dept., Washington, D. C., plans the construction of a battery storage and overhaul building. $240,000.

Calif., Oakland—J. Raymond, 626 17th St., will build a 1 story, 25 x 25 ft. metal pattern shop on 51st Ave. Work will be done by owners forces.

Conn., Rocky Hill—Connecticut Terminal Corp., 22 Charter Oak Ave., Hartford, awarded contract for a 1 story, 40 x 150 ft. service station on Connecticut River. Estimated cost $40,000.

Conn., New Haven—Municipal Airport Commission, awarded contract for the construction of an airport including service buildings, etc., at Morris Cove. Estimated cost to exceed $40,000.

Del., New Castle—Intercontinental Pipe & Mining Co., c/o Herbert Kennedy Cast Iron Pipe Co., 122 East 42nd St., New York, N. Y., plans reconditioning and equipping steel plant here. Estimated cost $1,000,000.

D. C., Washington—Standard Oil Co. of New Jersey, 241 Pennsylvania Ave. N. W., will soon award contract for a 6 story, 71 x 336 ft. service station and office at B. Second and Thrid Sts. N. W. Estimated cost $1,000,000. C. N. and N. Friz, Lexington Bldg., Baltimore, Archts. H. F. Doeleman, Baltimore Trust Bldg., Baltimore, Engr.

Ill., Quincy—Bd. of Education, W. E. White, Secy., Musselman Bldg., will receive bids about Mar. 15 for a 3 or 4 story school including machine shop, etc., at 14th St. between Maine and Jersey Sts. Estimated cost $1,300,000. J. D. Chubb, 109 North Dearborn St. Chicago, Ill., and Behrensmeyer & Haffner, Western Catholic Union Bldg., Archts.

La., New Orleans—City plans a 3 story industrial college. Estimated cost $500,000. W. R. McCormack, 10006 Carnegie Ave., Cleveland, O., Archt.

La., Shreveport—Constructing Quartermaster, will receive bids until Mar. 5 for the construction of a maintenance shop, warehouse and garage at Barksdale Air field.

Md., Baltimore—American Cooperage Co., 118-150 North Kresson St., will build a 2 story, 50 x 80 ft. addition to plant.

Md., Baltimore—Dietrich Bros., 220 East Pleasant St., structural steel fabricators, ornamental iron work, etc., will build a 1 story, 200 x 400 ft. addition to plant to be used as punching, assembling, receiving and delivery department, at 28th and Reese Sts.

Md., Baltimore — Crown Cork & Seal Co., Eastern Ave. and Kresson Sts., is having plans prepared for a 1 story machine shop at Eastern Ave. and Kresson Sts. L. R. White Jr., Court Sq. Bldg., Archt. Noted Feb. 12.

Md., Baltimore—Duraflex Co., Inc., 11 East Pleasant St., manufacturers of composition flooring, will build a 1 story addition to plant, including equipment.

Mass., Belmont—Electric Light Dept., Concord Ave., is receiving bids for a 1 story, 50 x 110 ft. garage, etc. Estimated cost $45,000. Private plans.

Mass., Cambridge (Boston P. O.)—Jenny Mfg. Co., 8 India St., Boston, awarded contract for a 1 story service and filling station at Concord Ave. and Alewife Brook Parkway. Noted Feb. 5.

Mass., Lynn—Hurley Estate c/o Campbell Bros., 99 Sagamore St., Contr., awarded contract for rebuilding machine shop at 529 Union St. recently destroyed by fire.

Mass., Quincy (br. Boston)—Standard Oil Co. of New York, Park Sq. Bldg., Boston, is having revised plans prepared for the construction of a garage, office, etc., between Town River and Washington St. here. Estimated cost $1,000,000.

N. J., Clifton—H. Holder, 242 Franklin Ave., Brooklyn, N. Y., Archt., is receiving bids for a 1 story, 200 x 235 ft. garage, etc., at Broad and Warren Sts., for Dugan Bros., 61 Arlington Ave., Newark. Estimated cost $150,000.

N. J., East Rutherford—East Rutherford Syringe Co., 75 Mozart St., is having plans prepared for the construction of a 2 story factory at 54 Mozart St. Estimated cost $40,000. J. T. Camlet, 26 Piaget Ave., Clifton, Archt. Noted Feb. 12.

N. J. Jersey City—J. Goldenberg, 80 Woodland St., Englewood, postponed construction of 4 story, 90 x 150 ft. garage, etc., at Sip and Summit Aves. here. $250,000. C. Shilowitz, 26 Journal Sq., Jersey City, Archt. Indefinite when project will mature. Noted Jan. 22.

N. J., Metuchen—Owner c/o A. M. Korff, 203 Park Ave., Plainfield, Archt., is having sketches made for the construction of a 2 story bus terminal here. Estimated cost $150,000.

N. J., Roselle—Hubeney Bros., 617 East First Ave., postponed construction of 1 story addition to machine shop on East First Ave. $40,000. W. L. Finne, 1201 East Grand St., Elizabeth, Archt. Maturity about April. Noted Feb. 5.

N. Y., Brooklyn—Bayridge Fireproof Storage Co., c/o A. Kaiser, 322 9th St., plans a 105 x 150 ft. repair shop, service garage, etc., at 5th Ave. and 63rd St. Estimated cost $125,000. H. G. Harrington, 311 100th St., Archt. Noted Feb. 5.

N. Y., Brooklyn—R. E. W. Realty Co., Inc., 160-09 Jamaica Ave., Jamaica, will build a garage and service station at 20th Ave. and 7th St. Estimated cost $45,000. M. Marlo, 200 Beverly Rd., Archt. Work will be done by separate contracts. Maturity about Nov.

N. Y., Brooklyn—D. H. Yoeman, 89-15 187th St., Hollis, will receive bids in late fall for the construction of a service garage at 54th St. and 21st Ave. Estimated cost $50,000. J. A. Boyle, 367 Fulton St., Brooklyn, Archt. Noted Nov. 20.

N. Y., Buffalo—American Lithographic Co., 60 Amherst St., will soon award contract for addition to plant on Elmford Ave. Estimated cost $40,000.

N. Y., New York—Berk-Lafayette Realty Co., L. Berkowitz, Pres., will build a 2 story, 80 x 145 ft. service garage at 403 Lafayette St. Estimated cost $75,000. D. S. Lang, 1860 Broadway, Archt. Work will be done by separate contracts. Maturity about Apr. 1. Noted Jan. 29.

N. Y., New York—Consolidated Gas Co., 4 Irving Pl., plans the construction of a 3 story shop at 500 East 63rd St. Estimated cost $350,000. J. F. Hunter c/o Owner, Archt.

N. Y., New York—Dept. of Parks, plans the construction of garage, shop, etc., at Birdall Ave. and Bronx Park. Estimated cost $125,000. J. Dusenbury, 2382 Grand Concourse, Archt.

N. Y., New York—Ranco Realty Corp., B. Alpren, Pres., 527 Tiffany St., is having sketches made for a 1 story, 100 x 100 ft. work shop at Tiffany St. and East Bay Ave. Estimated cost $40,000. N. Rotholz, 155 East 42nd St., Archt.

N. Y., New York—Star Co., 200 South St., will award contract in March for the construction of a warehouse and industrial building at 419 Water St. Estimated cost $95,000. Lockwood, Greene & Co., 100 East 42nd St., Archts. Noted Jan. 22.

O., Canton—Union Metal Mfg. Co., 1432 Walnut Ave. S. E., awarded contract for a 1 story, 60 x 340 ft. factory for the manufacture of metal steel lighting posts and steel trolley poles on Maple Ave. N. E. Estimated cost $40,000 to $50,000.

O., Cleveland—General Electric Co., River Rd., Schenectady, N. Y., awarded contract for the construction of first unit of wire mill. 322 x 412 ft. here $1,000,000. Total estimated cost $3,000,000.

Ore., Portland—Beaver Wood Products Co., will build a 1 story, 48 x 258 ft. plant for the manufacture of wood specialties. Estimated cost $41,000. Work will be done by day labor. Noted Jan. 29.

Pa., Philadelphia—Bureau of Yarks & Docks, Navy Dept., Washington, D. C., will receive bids until Mar. 4 for addition to shop building at Marine Corps Base here. $200,000.

Tex., Fort Worth—City will soon award contract for repair shop at Meacham Airport Field.

Tex., Presidio—Atchison, Topeka & Santa Fe Ry. Co., Amarillo, Tex., postponed construction of a cross tie creosoting plant on the Rio Grande River here. $100,000. W. W. Kelly, Amarillo, Ch. Engr. (Western Lines) Project in abeyance. Noted Jan. 15.

Virginia—Virginia Electric & Power Co., 7th and Franklin Sts., Richmond, plans to expend $4,000,000 for improvements during 1931 including several garage buildings in Richmond, Petersburg, Norfolk, Portsmouth and Fredericksburg.

Va., Hampton Roads—Bureau of Yards & Docks, Navy Dept., Washington, D. C., will receive bids until Mar. 11 for a 160 x 203 ft. addition to hangar and shop building here.

B. C., Steveston—Easthope Bros., Ltd., West Georgia St., Vancouver, plans the construction of a sales and service station here.

Ont., Kingston—Bd. of Education, plans the construction of a technical school. Estimated cost $350,000. Architect not selected.

Ont., Toronto—Bd. of Eduction, 155 College St., plans additions to following technical schools during 1931 including 2 story addition to shop at Central Technical school, 3 story addition to High School of Commerce, etc. Total estimated cost $445,000. C. Dyson, 155 College St., Archt.

T. H., Pearl Harbor—Bureau of Yards & Docks, Navy Dept., Washington, D. C., plans the construction of an engine and aircraft overhaul shop, here. Estimated cost $220,000.